Using computers in the workplace : a study of informal learning and perceptions of computer literacy in a manufacturing company

Thesis

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Jean Barnett
M0868724

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Abstract

The personal computer has become a common feature of the workplace, underpinning the jobs of many people. The achievement of some level of ability to use a computer is now regarded as a necessity, and this is reflected in UK government education policy. At the same time, the workplace has gained recognition as an important site for learning. This research study focuses on the need for people to learn to use computers in the context of the wider debates about workplace learning. Formal courses and training programmes cater for the need for adults to achieve some level of ability to use computers, often referred to as *computer literacy*. However, such courses may not be sufficient or effective for some people, and the precise meaning of the term computer literacy is unclear. The research study explores the *learning strategies* that people employ in order to acquire their computer knowledge and skills. It asks: how computer technology has affected individuals in the workplace, what individuals think computer literacy means, how people learn to use computers and whether this learning is transferred between home and work.

Using an interpretive methodology with survey and case study approaches, these questions are explored within the context of one workplace, a manufacturing company situated in the UK. The methods used are a questionnaire, semi-structured interviews and a respondent diary. The study explores the viewpoint of all employees of the company, not just managers or those responsible for staff development.

From the analysis of the data it is argued, *inter alia*, that:

(i) the computer has had an impact on the working lives of the people at the site of the study, bringing changes that require them to have some level of computer ability,

(ii) computer literacy is not easily defined but there are perceptions of it as: related to the needs of the job; having levels; and involving affective factors,

(iii) people may use a number of different strategies in order to acquire their computer ability, with a preference for informal learning,

(iv) computer learning is transferred between work and home, and people may develop higher levels of computer ability than is required for their work.

The study confirms informal workplace learning as a major means of acquiring computer skills and knowledge. Although a model of such learning remains elusive, it is suggested that it may be situated, not at the social-anthropological level of a community of practice, but at the level of individual relationships, with aspects of mentoring. The study indicates that a number of issues require further research: the need to include affective factors in provision for computer learning, the consideration of alternative models of situated computer learning and the place of self-direction in the acquisition of computer literacy.

Declaration

No part of this dissertation has previously been submitted for a degree or any other qualification of this or any other university or institution.

Contents

Appendix A

Appendix B

List of tables and figures

Tables

Figures

Chapter 1 Introduction

Background

This research study is about that aspect of workplace learning that concerns the personal computer, its presence in our working and private lives, and how people learn to use it. Change engendered by the development of technology is not a new phenomenon, but the pace of change connected with the computer and with information technology (IT) *is* new. From 1800 to 1950 there were a number of developments in information storage methods, logic, programming and electronics, such as the Jacquard loom, Babbage's Difference Engine, Hollerith's punch cards and the ENIAC computer, (Orilia, 1986). However, in the latter half of the twentieth century there was a more rapid development of computers through five generations, from those using valves to those using integrated circuits on a very large scale (Open University, 1992). Out of the latter came the personal computers that we know today.

In the relatively short period since the 1970s, computerisation has had a dramatic and fundamental impact on society, changing the way that we organise and store information, communicate, produce goods and services, and influencing our education, leisure and working lives. For example, the provision of resource-based learning is increasing, often involving the use of a computer, either as a means of searching for information or as the teaching medium itself. In leisure activities, from computer games to accessing the Internet, the computer is ever-present. In the workplace, the ability to use computers has progressed from being a specialism involving a few people to underpinning the jobs of many; the achievement of some level of ability to use a computer is now a necessity for most of us. The widespread acceptance of this necessity is apparent in European and UK government policy, (Commission of the European Community, 2000; DfES, 2002). In a recent Skills Strategy White Paper (DfES, 2003:62) basic Information and Communication Technology (ICT) skills are referred to as a third area of

adult basic skills, the other two being literacy and numeracy. We have to use computers but how do we learn to do this?

Technological change has influenced the form and content of adult learning provision in various ways. In terms of form, ICT has brought us e-learning and Virtual Learning Environments. In terms of content, courses such as Computer Literacy and Information Technology (CLAIT) and the European Computer Driving Licence (ECDL) attempt to cater for the need for adults to achieve some level of ability to use computers, often referred to as *computer literacy*. However, such courses may not be adequate or effective for many people, and the precise meaning of computer literacy is unclear: it may be the technique of being able to use a computer, or it may be seen as some kind of extension of, or alternative to, print literacy. The difficulty of definition is reflected in the first of the six key messages of the EU memorandum on Lifelong Learning (Commission of the European Community, 2000). This includes IT skills among the new basic skills, defined as:

> '...those required for active participation in the knowledge society and economy...' (Commission of the European Community, 2000:11).

However, the memorandum also uses *digital literacy* as a synonym for IT skills but does not provide a definition of either term.

Technological change raises a series of questions concerning the way that people work, the skills and knowledge that are now needed for work, the different interpretations that people have of what it means to be computer literate, how people perceive the computer that has entered their lives and how they have learned to use it for work and leisure. The broader context of this research study is thus one of the changing nature of work under the impact of technological change, specifically that of computerisation and IT. This context encompasses general themes of globalisation (Reich, 1992; Rifkin, 1995); new ways of working in a 'post-Fordist' era (Brown and Lauder, 1999); government policy responses to the need for new knowledge and skills as a basis for economic competitiveness, (DTI, 1995); the

strategies that people use to acquire their computer literacy and the nature of that literacy (Mace, 1992; Bostock and Seifert, 1986). The study focuses on the computer and computer literacy as micro examples of the wider debates about work, skills, learning and literacy (Lave and Wenger, 1991; Eraut *et al*, 1998). It is not about the world of IT or the computer specialist, nor is it about cognitive learning styles (Honey and Mumford, 1982; Wolf and Kolb, 1984); it is about a workforce whose members use computers as tools in their daily lives and who have adopted a range of learning strategies to facilitate this usage.

For me as the researcher, the study is the culmination of the ambivalent relationship that I have had with computers since I first encountered one on an Open University course in 1983, and particularly after I began to use them in the workplace in the early 1990s. My experience was one of constant frustration with software that I found difficult to use, and I found little in the way of learning support in my workplace other than demonstrations by colleagues. This caused me to reflect on why I was experiencing difficulty and why, despite attending an evening class in CLAIT and reading various books, I did not have the confidence that I felt I should have had in using the computer. In my MA studies (Barnett, 1997) I explored the barriers that adults encounter in their attempts to learn how to use computers. This highlighted for me the need to explore further the idea of computer literacy and of how people acquire it.

In my current workplace, a higher education institution, there is an assumption that everyone can and will use a computer. Some basic training courses in standard applications are provided, but I, and many of my colleagues, cannot cope with the technical problems that the computer brings. Also, I am aware that a number of colleagues are refuseniks to some degree, that is, they will not engage with computers. For example, one colleague refuses to allow a computer to be placed in his room; another refuses to use a word processor. My experiences have caused me to question not just how and to what level people learn to use computers, but also what they think about the computer and computer literacy. I am interested in how

others, who perhaps work in a different environment where learning is not necessarily the focus of their employer's business, learn how to cope with computer problems. In my work, I design learning materials in a number of subject areas, including basic computing, and I want this study to be of relevance to fellow professionals who either provide learning opportunities for adults or have an interest in the learning strategies used by individuals in the workplace.

Site of the study

The workplace as a site for research into learning is currently to the forefront in discourses of the knowledge-based economy (Evans and Rainbird, 2002). The site of this study is an American-owned manufacturing company with 169 employees at the start of the empirical research, based in Tyne and Wear. The plant concentrates on a range of similar products for the construction industry, although the worldwide company produces other related goods. The Tyne and Wear plant uses computers in most functional departments and has a single on-site IT manager. There are no other IT professionals at the site. Most employees at the plant report to the local plant manager, although a few report to the UK headquarters in London. In organisational terms the company has a matrix structure, that is, functional departments are organised hierarchically but overlain with cross-functional project teams and groups, created to respond to new demands and problems, (Pedlar *et al*, 1991; Mullins, 1996).

Although the research study is concerned with individual employees at the site and does not address general themes of staff development or training provided by the company, it is useful to note that the training policy at the Tyne and Wear plant centres on a training needs analysis carried out annually, with computer training for most staff provided on site by an external consultant. A few users of specialist purchasing software have had training at the company's American headquarters, and those engineers who need to update their computer-aided design skills have sought training off site from a private training provider. All training provision is driven strictly

by the company's business objectives. In this dissertation I do not intend to identify any respondents by name and I have used *Upworld* as a pseudonym for the company.

Originally, I intended to carry out my research with a slightly different focus in an organisation that brokered learning opportunities for those in the SME (small to medium enterprise) sector, with the majority of learners who registered being engaged in IT-related learning. However, I had difficulty obtaining access, and after an attempt to refocus the research elsewhere also failed for lack of access, I refocused the research on the site at Upworld. Although this was a difficult period for me, causing delays in piloting the research instruments, it provided me with the opportunity to reflect on these frustrations to the ultimate benefit of the research process.

Key themes

Essentially there are two key themes developed in this study, computer literacy and learning, and I want to introduce them briefly.

The term *computer literacy* may be constructed either through the discourse of literacy or through that of skills and competence (Limage, 1993). Even this distinction is becoming more complex as theories of multiple literacies are developed to include both conventional print-based text and screen-based media (Tuman, 1992; New London Group, 1996). There are therefore conceptual difficulties surrounding computer literacy and skills, as views of what constitutes reading and writing are changing. Although the need for computer literacy seems at times to be driven by economic concerns, computers are a function of leisure and home life as well as work, so there are issues of whether computer literacy is solely work-related (Haigh, 1985; Conlon, 2000). The economic concerns have also had an impact on learning, and various change factors have influenced the increased interest in learning for life and in what is termed *lifelong learning* (Stock, 1996).

Technological change, especially in the area of ICT, has been viewed in relation to economic change, particularly in the context of the presumed need for the UK to compete in a global economy (DTI, 1995). Thus, coping with technological change has become viewed as an essential factor in maintaining this competitive edge. The UK Government's education policy has been framed for some time in this discourse of economic and technological change, focusing on education for flexibility and mobility in the workforce (DTI, 1995; DfEE, 1998; Finegold, 1999). The argument is that if the economy needs flexible, multi-skilled people, then educational provision must cater for these needs, hence the development of courses such as CLAIT and ECDL referred to earlier. However, provision in the form of courses or training programmes that guide the learner through the mechanics of using applications such as a word processor or spreadsheet, may be inadequate for two reasons. First, this represents only one construction of computer literacy and second, it represents only one way, a supply-led, provider-centred way, of attaining computer literacy, where affective factors such as confident use of the computer are absent, (Boud *et al*, 1993). This study will look at how change, particularly the need to cope with rapid technological change, is influencing the conceptualisation of computing and IT pedagogy in one of the various settings for adult learning and training, the workplace. Here, as this study will show, people may use learning strategies that are less formal than structured courses and training in order to acquire their knowledge of how to use computers.

The research questions, methodology and analysis

As the organisation of work changes, it seems to demand more self-reliant learners who can cope with change. One aspect of change is that expertise no longer consists of the mastery of a defined set of skills; knowledge is changing. In order to avoid confusion, and to emphasise that I am talking of learning in the context of the use of computers, I have used the term *computer learning* in this dissertation. Thus, the research questions are set in the context of computers and ask how work has changed for the individuals in the study, how these individuals perceive their computer skills and

knowledge, what kind of learning goes on and whether their computer learning is bounded by their workplace. In summary, my questions are:

1. How has computer technology affected individuals in the workplace in terms of work itself and the way they work?
2. What do individuals think computer literacy means for them and how do they feel about the computer?
3. How do people learn to use computers?
4. Is their learning transferred in any way between home and work or, if there are boundaries, what is their nature?

The research study is exploratory so the literature review functions not only as an overview of my areas of interest, but also allows me to develop my research questions. The questions are presented at this point in the text but their formulation was by no means firm at the outset of the research study. They derive in part from my context and themes, and in part from the literature review. Chapter two of the dissertation reviews the literature covering issues of the changing world of work; aspects of literacy and computer literacy; and various aspects of workplace learning.

My purpose and focus are bound up with what people think and with their ideas about learning and computer literacy. I want to analyse what people say, but the data that I shall collect cannot be representative of an objective reality. My approach fits the interpretivist paradigm, which sees knowledge as subjective and socially constructed, and I have used a largely qualitative approach with a preliminary questionnaire, followed by semi-structured interviews as the principal research instrument, together with a respondent diary. This approach was chosen because I wanted to focus on how people learnt to become computer literate and what they thought that meant. Chapter three of the dissertation provides an overview of the methodology literature leading to a justification for the interpretive approach and for the choice of methods and instruments used in the study.

Chapter four of the dissertation covers the first phase of the empirical work: the design, piloting and administration of the questionnaire, and the analysis of the results to provide preliminary data about the respondents and their use of computers. This phase is also crucial in providing a list, for use in the second phase, which shows how respondents ranked a number of possible attributes of a computer literate person. Chapter five covers the second phase of the research: the sampling strategy used to select the respondents; the design, piloting and conduct of the interviews; and the analysis of the interview data and of the respondent diary.

Chapter six presents a discussion of the analyses of the questionnaire, interview and diary data, giving a more general view of the ideas that have developed from the research and providing the basis for answers to the research questions. I shall argue from the analysis of the data, *inter alia*, that the research questions can be answered as follows. First, the computer has become a ubiquitous feature of, and has had an impact on, the day-to-day working lives of the people at Upworld, who need new skills in order to be able to use computers. Second, computer literacy is not easily defined but that there are perceptions of it as related to the needs of the job, as having levels or as involving affective factors. Third, the people at Upworld have used a number of strategies in order to acquire their computer knowledge and skills, with a preference for informal strategies. Fourth, there is considerable transfer of computer learning between work and home such that many people's ability is under-used in the workplace. A general model of workplace computer learning, while remaining somewhat elusive, is suggested as being situated at the level of individual relationships and having aspects of mentoring.

The final chapter of the dissertation presents a summary of the research study, a justification for its originality and its relevance for practitioners, some suggestions for future research and my own reflections on the strengths and limitations of the research study.

Summary

This opening chapter has laid the foundations for the dissertation. It has presented an introduction to the background of the research study and the issues to be explored, a description of the site for the empirical study, the key themes, the methodology to be used and the research questions on which the study is focused. The dissertation now proceeds to chapter two, to begin the exploration of these questions with the literature review.

Chapter 2 Literature review

Introduction

This chapter presents a literature review that draws on sources from the academic disciplines of economics, computing and human resource management, as well as adult education to illustrate the background to the research study and its key themes of computer literacy and learning that are reflected in the research questions. The background, of technology and the changing nature of work, is illustrated by the review in the first subsection that covers theories of globalisation, post-Fordism and skill needs. This review is reflected in the first research question: how has computer technology affected individuals in the workplace in terms of work itself and the way they work?

The second subsection looks at the literature relating to debates surrounding the key theme of computer literacy and its connection, or lack of it, to literacy and the new literacies, to provide the background to the second research question, which asks what individuals think computer literacy means for them. The review itself prompted me to extend the question and ask how people feel about the computer.

The second key theme of the research study, learning, is illustrated by the remainder of the literature review, where subsections cover the learning organisation, workplace learning, informal learning and situated learning, to provide the background to third research question, which asks how people learn to use computers. The review touches on, but has not taken an extensive account of, the literature of apprenticeship and mentoring; the empirical study indicates this as an avenue of future research. The review also prompted an additional research question: whether computer learning is transferred in any way, crossing the boundary between home and work.

The changing nature of work

The literature here provides an overview of the wider context within which to explore shifting notions of computer literacy and learning. It is an area whose arguments are well rehearsed, so this review is confined to a summary. I shall illustrate the changing nature of work by reference to the (contested) theories of globalisation and the post-Fordist society.

Globalisation has been a key theme of many writers and has been variously interpreted. Geographically, it refers to the linking of distant localities so that local events are affected by events occurring thousands of miles away, (Giddens, 1990). Economically, it refers to the global organisation of production, capacity and distribution, (Castells, 2001). The literature reviewed in this study is pessimistic in its view of globalisation as a driver of change, altering the shape of the workforce, creating the requirement for 'knowledge workers' and predicting, in an almost apocalyptic way, an end to work as we have known it. Typical of what I shall term the apocalyptic school, writing in the early 1990s and in an American context, are Aronowitz and DiFazio (1994), Reich (1992) and Rifkin, (1995). In this new world of work, knowledge is bound up with technology; it is a commodity:

> '...transformed into information that requires no productive object...' (Aronowitz and DiFazio, 1994:17)

and has become the main productive force. Reich (1992) describes a transition from 'high volume' to 'high value' work, part of the discourse of post-Fordism addressed later in this subsection. In this high value world, new skills are required in the workplace, exemplified in the work of the *symbolic analyst* who uses items that:

> '...do not enter world commerce as standardized things – Traded instead are the manipulation of symbols – data, words, oral and visual representations...' (Reich, 1992:177)

The significance for learning is that the symbolic analyst may not need to master domains of knowledge, just the means to draw upon them. This argument raises an important issue for the research study, since the

manipulation of these representations may not take place in print. Rifkin's (1995) particular emphasis is on the effects of computerisation. He describes a polarised, high-tech, global economy, controlled by an information elite, with a mass of workers for whom there are few employment prospects. He provides a detailed economic history to support his argument that America, and by implication, the rest of the world, has chosen the dystopian possibilities of unemployment and global depression that computerisation can bring, instead of the utopia of leisure and liberation from labour. When added to the themes of capitalism under threat from technological change and high value work requiring different skills, this becomes part of the discourse of post-Fordism.

The terms *Fordism* and *post-Fordism* refer to models of political economy. Brown and Lauder's (1999) comparison of these terms associates Fordism with mass production processes such as assembly lines, specialised machinery and a standard product and is thus significant for this study, bounded as it is by its manufacturing setting. By contrast, post-Fordism incorporates global competition, flexibility of systems and of workers, and flatter organisational structures. A crucial feature of this contrast is that while the Fordist model requires production workers generally to have little formal training, post-Fordist flexibility requires all workers to engage in the constant updating of their skills so that they may function in a high-wage, high-skill employment sector. This, in turn, feeds into the discourses of lifelong learning and the skills gap that have dominated UK policy response to the globalisation debate. It has been argued that there is a:

> '...presumed connection between Britain's education and training policy and its nation-state-based strategy to modernise the economy, improve its global economic performance and generate high-skill jobs...' (Avis, 1996:7)

The debates around this presumed connection encompass themes of a skills mismatch (Haughton, 1993; Felstead *et al*, 1999), supply and demand of vocational education provision (Esland, 1996), the low-skills equilibrium (Finegold and Soskice, 1988; Finegold, 1999) and criticism of solutions

such as the National Vocational Qualification (NVQ) system, (Keep, 1993). What is relevant to this study in these debates is how government policy has affected educational provision for adults.

UK government policy in the later 1990s stemmed from three reports: the Kennedy report on further education, *Learning Works* (Kennedy, 1997), the Dearing report, *Higher Education in the Learning Society* (National Committee of Enquiry into Higher Education, 1997) and the Fryer report on continuing education, *Learning for the Twenty-first Century* (Fryer, 1997). Tight (1998) examines them in the context of the discourse of lifelong learning. Essentially arguing for a rejection of a model of 'once-and-for-all' learning confined to childhood, lifelong learning is learning:

> '...portrayed as a process which everyone is involved in throughout life...' (Tight, 1998:474).

I would agree with Tight's (1998) view that the concept of lifelong learning portrayed in this trio of reports and in the associated Green Paper *The Learning Age* (DfEE, 1998) over-prioritises vocational education and training. Blame is placed on non-participants, who need to change their behaviour, and social and economic exclusion is threatened to those who do not. All three reports accept arguments for lifelong learning but these are:

> '...grounded in fairly simplistic assertions about the need to increase economic competitiveness by producing more knowledgeable, skilful and hence more productive workers...' (Tight 1998:477).

The discourse of lifelong learning is associated with notions of the learning society and the learning organisation. The latter is of particular interest in the context of this research study, which explores change and learning in one organisation, and is reviewed later in this chapter.

The uncritical acceptance of theories of both globalisation and post-Fordism has been challenged. Brown (1999:3-4) argues that globalisation has been viewed as a process of change, as an objective entity and as a discourse of inevitability. He prefers to use the term as descriptive of economic and political phenomena, arguing that it is *not* inevitable and it *is* the product of

human agency. Transformations are *within* the system of production, not *of* it. In my view, Brown's (1999) argument casts doubt over whether globalisation should be regarded as a neutral concept, and if it does not have that status, then perhaps the skills shortage and mismatch arguments that follow from it are also to be viewed as part of the discourse of inevitability and are therefore contestable.

Post-Fordism has also been criticised as a myth (Avis, 1996), and a paradise for the few (Edwards, 1993). Edwards' (1993) critique suggests that the response to economic change expressed in terms of a call for a trained, skilled, flexible workforce may create an uncertain future for many people. Brown and Lauder (1999) present the alternative model of *neo-Fordism*, characterised by insecurity and low-skill, low-wage temporary employment where workplace training meets only the employer's immediate needs. Murphy (2000), whilst acknowledging that changes have occurred globally, suggests that the reality is more that:

> '...The world has not suddenly become a global economy, but rather has found itself transformed into a highly *internationalised* economy...' (2000:170, my italics)

Internationalisation is not the same as globalisation. Multinational firms and financial markets are economic entities, but as Murphy (2000) points out, the domestic economy is still shaped by the nation-state.

In my view, the predictions of the end of work articulated by the apocalyptic school may be subject to debate, not least because there was an expansion of global economic activity during the late 1990s (OECD, 2000). While there have been reductions in the number of manufacturing jobs in the UK, (Office for National Statistics, 2003), there has been a growth in employment, suggesting that it is too simplistic to equate 'work' with 'manufacturing'. There are, however, interesting aspects of the work of the apocalyptic school that have relevance for this research study. One of the most important is the nature of knowledge and skill, in itself a complex debate. In tracing the history of work, Aronowitz and DiFazio (1994) argue for a distinction between craft-skill and knowledge-skill. They cite

Braverman's (1974) argument that if power in the hierarchies of capitalism is based on skill, then new technology de-grades workers because it means deskilling, that is, less craft skill is needed. They further argue that the tacit knowledge of materials, required in the craft era, was no longer required with the advent of synthetics. One effect of this is a widening gap between intellectual, technical and manual labour. Braverman's (1974) position on deskilling can be set against Adler's (1988) view that, far from de-grading workers, new technology creates new skills. Adler (1988) constructs knowledge as skill; what is new in the new technology is the reliance on mental rather than physical effort. It seems to me that the argument allows an alternative perspective if craftsmanship is seen as stored in the mind of the craft worker rather than as residing in the manual skill. This perspective might then be applicable to the use of computers, if it is argued that uncertainty cannot be handled by computers; human judgement is always needed (Koike, 2002). Technological change, then, may deskill or introduce new skills. If, as Aronowitz and DiFazio (1994) claim, the computer program has become the manager of work and the workforce, then the ability to create the program is the means of mastery, since the computer is powerless without the program. If literacy is empowerment, and, as discussed later, Archer and Costello (1990) argue that it may not be, then computer literacy constructed as *literacy* might therefore have to include the ability to program. If computer literacy is constructed as *skills* then it may imply only operator tasks.

The commentators of the apocalyptic school also argue that the shifting nature of work changes rather than removes the old hierarchies that are a feature of the organisation of work known as Taylorism (Aronowitz and DiFazio, 1994). Using *scientific management* principles, Taylor (1911) recommended the sub-division of work to maximise productivity, resulting in workers specialising in (often) low-skilled tasks. Aronowitz and DiFazio (1994) see the new gap between manager and the managed partly as:

> '...a function of different access to control over the most advanced technologies, especially with respect to their language and applications...' (1994:70)

The Taylorist hierarchies of labour are, for them, reflected in the computing hierarchy: systems analysts have broad responsibilities; the work of programmers is bounded by the system; and operators have only routine work. Thus the distinction between programming and operation reinforces the older hierarchy of design and execution. This raises questions of the implications for learning in the new world of work, if direct production-related activity is marginalised, including whether this change in knowledge requirement is reflected in the construction of computer literacy. If the craft-era concept of skill as manual dexterity has given way to a concept of skill as knowledge or competence, this will have implications for the acquisition of computer literacy. It may be that there are intellectual, technical and manual levels of computer literacy, a point that I develop in the next subsection.

Current UK government policy emphasises the need for information and communication technology (ICT) skills (DfES, 2002 and 2003), which, necessarily, require the ability to use a computer. The literature review has already referred to the problematic notion of skill: the term can refer to manual dexterity; to key skills such as literacy, numeracy and the use of IT; or to personal characteristics such as motivational or negotiating skills. This is illustrated by the following quotation from Hendry's (1999) research for the National Skills Task Force report on new technology industries:

> '...it takes about five years to make someone really effective as a glass blower – they may not have the brains of a graduate, but the skill level they have is enormous...' (1999:26).

The respondent clearly did not equate skill with academic knowledge. The National Skills Task Force report also noted that:

> '...in manufacturing, many firms need employees with only low levels of skill...' (Hendry, 1999:26).

It is also possible that employers fail to utilise higher-level skills, even when they are available (Flude and Sieminski, 1999). There may be a skills/knowledge base in the workforce that is underused or untapped; if so, this would support Livingstone's (1999) analysis that argues not for a skills

gap but a jobs gap, in a workplace where adult learning and knowledge are underemployed. In his analysis of underemployment, '...the wasted ability of the eligible workforce...' (1999:171), Livingstone (1999) refers to the credential gap between qualifications and job entry requirements, and the performance gap between qualifications and task requirements. Writing in a North American context, Livingstone (1999) quotes statistical evidence for the growth of participation, particularly in further education and in adult job training programmes, which leads him to argue that there is:

> '...a labour force that is even more highly educated, but without some of the specific technical vocational skills that may be immediately required to do some specific jobs...'(1999:169)

Theories of the knowledge-based economy rest on the argument that more skill, creativity and critical thought are required to handle information than to handle raw materials, but Livingstone's (1999) argument is that the acquisition of knowledge and qualifications is outpacing this requirement. Livingstone's (1999) arguments are applicable to the UK context, where credentialism is also apparent in the promotion of National Learning Targets and the NVQ system, (Fuller and Unwin, 1999).

This part of the literature review has drawn on various commentators on the background of change in perspectives of both the workplace itself and the learning needed to participate in work. It has raised the need for questions to be asked in the research study about the impact of computers on work at Upworld, about the kinds of computing skills that people need, or think they need. It has also raised the possibility of manual, technical and intellectual levels of computer literacy. The review now turns to the literature relating to the nature of computer literacy.

The nature of literacy and computer literacy

In this section the literature review attempts to unpack the term *computer literacy* by looking first at the notion of *literacy* then at how computer literacy has been defined and finally at newer ideas of *multiliteracies*.

Literacy

Studies of literacy tend to agree that there is no one definition of literacy (Mace, 1992) but one distinction is between functional, cultural and critical literacy, distinctions that are themselves multiple, (Lankshear *et al*, 1997:40). Functional literacy is the basic ability to read and write, cultural literacy involves knowledge of culture and society, while critical literacy requires the ability to analyse cultural forms (Kellner, 1995). The literacy campaigns of the 1970s assumed that functional literacy was desirable and promoted it as a means to employment (Mace, 1992). The wider concept of literacy may be variously constructed, for example as a set of skills or as a much more powerful cultural activity (Limage 1993).

Print literacy is the subject of a vast amount of research and comment but some sources are particularly interesting for this study in that their arguments might apply equally well if the descriptor *computer* is inserted before the word *literacy* (Archer and Costello, 1990; Mace, 1992). Archer and Costello (1990) conclude their evaluation of the 1960s popular education movement in Latin America by reviewing the nature of literacy, including forms other than print. They produce a useful typology by asking whether literacy is a technique, the development of critical consciousness, empowerment, the expression of needs or an indicator of the level of democracy. They reject the construction of literacy as a set of techniques but favour interpretation as the ability to express needs and desires. There is thus a strong sense in which only the learners can define their literacy level (Archer and Costello, 1990:201). Their approach seems to me to be fundamental to an enquiry into the nature of computer literacy. For example, constructed as a set of techniques, computer literacy becomes the ability to create and input data into simple documents, spreadsheets or templates; constructed as the development of a critical attitude, it is more applicable to,

for example, the manipulation of spreadsheet data. Perhaps most significant is that if it is constructed as empowerment, it becomes the means of participation in leisure, education and work.

An alternative typology of literacy is that of Lankshear (1998) who identifies three constructions relevant to this discussion in his review of contemporary educational reform in North America, the UK and Australasia. These are the lingering basics, the fundamentals of encoding and decoding print texts; the new basics of application, problem solving and critical thinking; and the elite literacies of high level mastery of subjects or disciplines. He refers to the latter as:

> '...very much the literacy of Robert Reich's 'symbolic analysis'...' (1998: 356).

This, like the work of Mace (1992), seems to suggest that some sense of levels should be sought in attempting to define 'computer literacy'.

I found that Mace's (1992) work on print literacy also allows parallels to be drawn with computer literacy. For example, there is no single definition of the term literacy just as there is no single definition of computer literacy, and early literacy campaigns of the 1970s were expressed in terms of aid, while those of a later date focused on economic stability, just as recent UK government education policy has been articulated in terms of economic competitiveness. Mace (1992) re-examines the construction of print literacy in terms of the 'problem' of illiteracy, to which there is a solution, more literacy. Similarly, Limage (1993) refers to the print illiterate as:

> '...an object of charity, a welfare recipient...[with an] ...elusive source of personal shame...' (1993:78).

If the economic imperative lies behind the drive for computer literacy then the recipient of skills training is not a victim requiring aid but a piece of human capital. Thus there is a shift from seeing (computer) literacy as part of social or welfare policy to part of economic policy. Mace (1992) makes a point about the relationships between the print literate and illiterate, referring to the compounding of the stigma when library staff direct literacy students to catalogues that they cannot read. There is a parallel to this in the

provision of basic courses in IT skills that can only be accessed via a computer because they are on a CD-ROM. Mace (1992) also reinforces Archer and Costello's (1990) argument when she refers to research conclusions that learners' interests are firmer than their needs:

> '...the important thing is that the questions they ask derive from their own context, experience and knowledge...' (Mace, 1992:54).

This argument might not quite transfer easily to constructions of computer literacy since computer illiterates might not be able to do this. If adult learners have no experience of computers, it may be difficult for them to articulate what it is that they need to know.

Perhaps the most important message for the research study from Mace's (1992) work is the concept of status and literacy. She refers to class and education, noting that literacy problems are usually associated with manual workers, who occupy a low hierarchical position, and that *information technology* courses are for managers and have a higher status, (Mace, 1992:127). Archer and Costello (1990), referring to the misuse of Freirian concepts, find it objectionable that:

> '...the language associated with education for liberation [is] used as a tool for gaining control of people's lives, for domestication...'(1990:105).

This criticism could also be applied to those who use the term *computer literacy* to describe provision that is technique-based. A point for exploration in the research study here is the extent to which people at different levels in a company hierarchy are prepared to admit to any level of computer *illiteracy* and whether they express any sense of the personal shame referred to by Limage (1993)

Literacy, in the sense of expressing and communicating thoughts and ideas has taken many forms throughout history. If, as Mace (1992) suggests, there are active and passive or dominant and subordinate literacies in each age, then how each is achieved, and who achieves them, may change over time. However, the workplace hierarchies of the print era may not necessarily

continue into the computer era in the same way. Whereas managers once had secretaries to communicate their thoughts, they may now send their own e-mails, so there may be pressure on managers to learn new writing skills, including keyboarding. Recently, publicity has been given to a former government minister who apparently ran her department without ever sending an e-mail, perhaps as a mark of status (Brooks, 2003). It may be that the concept of the print illiterate as a victim or object of charity does not have a parallel in the new world of work, especially if some of the new computer illiterates are managers.

Computer literacy

Turning to computer literacy, there are distinct phases in the debate concerning its interpretation. Attempts at a definition during the early 1980s were made in an era before the all-pervasive nature of the personal computer and the Internet, and in a time when the use of computers was specialised. While this temporal location may detract from the usefulness of the early debate, there is a certain consistency that is lacking in the later literature. Most definitions of the 1980s include appreciation of the commercial and social applications of the computer and understanding of technical language, as well as knowledge of the applications, (Banks, 1983; Lloyd *et al*, 1984; Bostock and Seifert, 1986). The main issue of the debate, which was so considerable that Bostock and Seifert (1986) were able to quote eleven different definitions, was whether programming skill was a necessary component of computer literacy.

An early problem identified by Banks (1983) was disaffection on the part of adult learners with courses, and he argued for improved provision with awareness courses to dispel myths, and more advanced post-awareness courses. Although wrong about the limited supply of adult beginners, Banks (1983) was right about the lack of clarity in specifying needs. Bostock and Seifert (1986) correctly predicted that adult educational activity would spread out from institutions, aided by personal computers in the home as a means of access to information. In a way that almost anticipates later theories of new literacy, Bostock and Seifert (1986) draw a parallel between

the developments in mass print literacy during the growth of the industrial society and in computer literacy in the post-industrial world, to argue that lack of computer literacy becomes the new basis of inequality. This leads them to recommend that it should not be treated as a new literacy in itself but as an increasingly important element of general literacy. This is now recognised in UK government policy, (DfES, 2002, 2003).

Although there was considerable debate in the 1980s about the need to include the ability to program, generally there was acceptance of the need to include affective as well as cognitive abilities. Computer literacy involved being at ease with the medium for communication and self-expression, and was linked with democracy and awareness of misuse (Bostock and Seifert 1984). Although affective factors in computer use have continued to be researched, the literature is part of the academic discipline of human computer interaction (HCI). This discipline is concerned with the design and evaluation of computer interfaces for human use, with the research aimed at improving the interface between the person and the machine. The research is carried out from a psychological rather than an educational perspective and typically uses quantitative methods. For example, Hasan's (2003) paper on the influence of computer experience on self-efficacy beliefs uses correlation and regression methods. Although I have not pursued this area of the literature, I have recommended it as an avenue for further research.

Archer and Costello's (1990) themes of literacy as empowerment and as the expression of needs and desires are reflected in Bostock and Seifert's (1986) claim that computer literacy expands the ability for analysis and for self-analysis. Empowerment leads to control and Illich (1973), writing before the advent of personal computers, had emphasised that it is important to know who is in control of tools. In terms of its manifestation as a tool, the computer of the early 1980s was most familiar as a mainframe, centrally controlled, rather than as a personal computer. Although the now pervasive nature of the personal computer might not have been envisaged, Haigh (1985:161) was accurate in his predictions, regarding computer literacy as

an '...amorphous concept...' but something that people need to know about to function effectively at work. He advocated:

> '...a careful rethinking of the general concept of literacy that includes the use of computers...' (1985:161)

and called it a '...knowledge worker's tool...'(1985:162).

Generally, during the 1990s the nature of the debate changed, and the usage of the term 'computer literacy' seems to become more casual. In American academic journals the debate was mainly directed at school curriculum content, referred to as a '...laundry list...' of skills taught in isolation (Johnson and Eisenberg, 1996:13). Hess's (1994) overview of the focus of American teaching on the subject suggests that after an era of concentration on the machine itself (1965 to 1980), then on competencies combined with social issues (1980 to 1990), teaching in the 1990s focused on programming, applications, operations and user attitudes. Although acknowledging the difficulty of defining the term, Hess (1994) suggests that by applying the term literacy to computers we are signifying that as a body of knowledge it is at least as important as reading and writing were in the past. However, he then appears to contradict this when stating that the purpose of his research is to:

> '...identify several *competencies* that will characterize the computer literate teacher in the 1990s...' (1994:1, my italics)

This juxtaposition of the concepts of literacy and competence prefigures a more recent attempt at definition that becomes almost the antithesis of literacy, when Lowther *et al* (1998) regard computer literacy, which they define as knowing the computer as a basic tool, as *inferior* to technological competence.

Other views, all of which raise issues for the study, include those of computer literacy as ideology (Goodson and Mangan, 1996), as something more modest and skill-based (Blake and Standish, 2000) and as the specific skill requirements that dictate course content (Saranto and Leino-Kilpi, 1997). Goodson and Mangan (1996) refer to:

> '...a largely ideological concept, whose fuzziness and internal contradictions mask the social, political and educational agendas of its proponents... (1996:65-66)

They locate this ideology in the debate over definitions in the 1980s and cite the needs of business and the military as the drivers of the introduction of the subject into the curriculum of Canadian schools, drivers that are certainly not value-free. Goodson and Mangan (1996) argue for a more focused and lower-level approach to classroom teaching, similar to Blake and Standish's (2000) visible, skill-based view of computer literacy, although elsewhere Standish (1999) had argued that it was inappropriate to call the acquisition of skills literacy. This skill perspective is exemplified in Saranto and Leino-Kilpi's (1997) study of requirements for computer literacy in nursing, beginning with their uncompromising definition of the term as:

> '...the ability to read and write with computers...' (1997:377).

Their study explores the competencies needed by nurses and the corresponding requirements for course content. This is clearly a contextualised view, but their clear methodological description was helpful in the design of the questionnaire used in this research study.

It is difficult to see how any of these constructions of computer literacy fit into the wider debate surrounding general literacy, for example, the typology suggested by Archer and Costello (1990), except as technique. An alternative construction comes from the attempt at a direct comparison between the terms literacy and computer literacy made by McMillan (1996), who, *inter alia*, questions why the term *computer numeracy* is not used. He proposes a new term, *comperacy*, to refer to the skills required to use a computer and make it do what the user wants. His use of this new term develops Papert's (1993) term *letteracy*. Papert (1993:11) uses this term to refer to the skill of reading words made up of letters, as opposed to 'literacy', which he reserves for knowing literature and understanding the world in a way that derives from knowing literary culture. Thus the computer literate person should know the world in a way that derives from

knowing computer culture. Although Papert (1993) is not specific about what constitutes computer culture, he clearly does not construct computer skills in terms of narrow, technical or practical knowledge because it goes out of date:

> '...the very idea of banking computer knowledge for use one day in the workplace undermines the only really important "computer skill": the skill and habit of using the computer in doing whatever one is doing...' (1993:51)

McMillan (1996) extends Papert's concept of letteracy into levels, suggesting similar levels of what he calls comperacy, as summarised in the table below:

Type of comperacy	Indicated by ability to
Systemic	physically and cognitively acquire at least one other level of comperacy
Situational	enter data, text or numbers, but have no knowledge of internal operations of the computer
Operational	work confidently with at least one interface and operating system and respond to error messages
Principal	handle tasks such as back ups, file transfer, disk formatting
Application	work confidently in several application programs such as a word processing program and a spreadsheet.

Table 2.1 Comperacy (Adapted from McMillan (1996:167))

Although unsupported by research evidence, this is a useful typology for consideration during the research and helps to inform the questionnaire (see chapter 4).

Newer forms of literacy

A further strand in the literature engenders new terms such as *mediacy* (Carbo, 1997), *multiliteracies* (Snyder, 1998; New London Group, 1996), *online literacy* (Tuman, 1992) and *information literacy* (Hancock, 1993). These new terms are the outcomes of attempts to understand how people 'read' and 'write' in new forms of media that are not paper-based. Carbo (1997) prefers the term mediacy recognising different competencies for each medium or information space (Carbo, 1997:39), finding computer literacy too narrow a term because it concentrates on the technology, ignoring the informational content. One advantage of the term mediacy is that it implicitly recognises that computers provide resources rather than knowledge. Johnson-Eilola (1998) echoes Reich (1994) when describing the two skills necessary for modern work as the ability to process multiple streams of information and the ability to experiment in problem areas. This is supported by Lankshear's (1998:9) comment that a thread of '...technologization...' can be traced across the constructions of literacy in his typology, referred to earlier, so that literacy becomes identified with computer-mediated text production, distribution and exchange rather than print, as we become increasingly dependent on the computer in our work and in other aspects of our daily lives. If engagement with the computer is necessary, then perhaps we need to think in terms of (computer) literacy rather than computer literacy in the workplace.

The term multiliteracies is used by the New London Group (1996) to describe the skills required to engage with representations of the modern world that involve the visual, audio and spatial modes of multimedia. Their work provides, albeit implicitly, a link to adult learning via Kolb's (1984) learning cycle. Kolb's (1984) cycle is based on engagement in an activity, reflection thereon, theoretical analysis and application of theory. The argument of the New London Group (1996) is based on pedagogy of situated practice, overt instruction, critical framing and transformation of practice, which seems to be reminiscent of the components of Kolb's (1984) cycle. This might usefully be applied in the study to the question of how workers acquire their computer skills in the workplace, and whether

managers allow time for reflection or theoretical analysis. It may be that engagement in activity or situated practice is the norm because that is all there is time for in a competitive environment that involves adapting to change as the dominant discourse.

Other terms for newer forms of literacy offered are online literacy, suggested by Tuman (1992) when he challenges the view that a society with ever-increasing levels of technology necessarily needs high levels of *computer* literacy, and information literacy. The latter is suggested by Hancock (1993) as one example of a number of literacies, each isolated by its vocabulary and conventions, but an empowering example for both teachers and workers as it requires a shift in their roles. There seems to be a connection here to Lankshear *et al's* (2000) challenge to the assumption that the printed word is the preferred medium for knowledge production or transmission. Their argument is based on philosophical responses to the technologies of the Internet rather than on discussions of any research evidence of usage, but they conclude that the mindsets associated with physical space and cyberspace may be incompatible, so that the ability to cope with modern life will depend upon:

> '...our willingness to problematise and rethink both the role and significance of knowledge and truth...' (2000:39).

In support of their argument they cite Lyotard's (1984) theory of knowing as performative: making, doing and acting. One effect of the changed status of knowledge according to Lyotard (1984) is a radical change in the composition of the workforce. This returns us to the theories of Aronowitz and Difazio (1994) and is echoed in Conlon's (2000) allegory of the workforce. Conlon (2000) relates a story of three workers in a cathedral. The technician says that he is laying bricks, the craftsman says that he is creating the north wall and the visionary says that he is worshipping God. Thus for the computer user, '...inputting data...' would imply a technician, '...writing a report...' would imply a craftsperson, while '...making profits for the company...' or some such, would imply a visionary. This is an interesting idea and may be useful in interpreting the interview data.

It seems important to explore these shifting concepts of literacy and multiliteracies in the context of the changing workplace. The site for the project is a long-established manufacturing company and the research study will therefore explore the changes in the narrower context of one case, to see if it reflects those alleged to be taking place in the wider context. There are parallels between the separate strands of the literature relating to globalisation and to computer literacy: globally, the nature of work is changing and the nature of literacy is changing too. There is a need for new skills in the technological workplace and for new kinds of literacy to read the new media; the next step is to consider how people acquire these skills. The review therefore now moves to look at the key theme of learning, starting with organisation-wide ideas of learning then focusing on the individual.

The learning organisation

The origin of this term and the ideas associated with it are often attributed to Senge (1990), a management specialist whose work is much quoted in subsequent literature. The term's history is somewhat longer. According to Pedlar *et al* (1991) the term *learning company* was first used by Holland (1986), director of the Manpower Services Commission, and he admitted that he didn't know its origins. It can be traced back to Schőn (1973) who argued that increasing global change, which he called '...the loss of the stable state...' (1973:28), was an aspect of modern life that necessitated learning on the part of all of society's institutions, including the business firm. With Argyris (Argyris and Schőn, 1978), Schőn was to develop a theory of single-loop and double-loop learning. Single-loop learning occurs when people simply detect and correct errors. Double-loop learning involves reflection and critical questioning of the underlying organisational rules and values that govern the problematic situation, thus providing potential for those underlying rules and values to be changed. The theories of Argyris and Schőn (1978) are relevant not only to the idea of the learning organisation but also to Kolb's (1984) theory of experiential learning, where reflection is also a key issue.

Senge's (1990) theory of the learning organisation is based on five component technologies, which he refers to as *disciplines*, and which he believes are vital if an organisation is to learn and enhance its capacity to realise its aims: systems thinking (his term for systems theory), personal mastery, mental models, a shared vision and team learning. Systems theory distinguishes between open systems that interact with their environment and depend upon transactions with that environment, and closed systems that do not (Buchanan and Huczynski, 1985:251). Organisations are regarded as open systems. Senge (1990) can perhaps be criticised for drawing on too much that is theoretical without providing research evidence to support his ideas and, taken individually, each of Senge's (1990) disciplines does not seem to be original. His perspective is that of the management consultant, concerned with the organisation, rather than the educationalist with a concern for the individual. Although his impact is probably greater in the field of Human Resource Management, three of the five disciplines of the learning organisation are relevant to this study: personal mastery, mental models and team learning.

According to Senge (1990), personal mastery is the special level of proficiency that enables someone to be committed to their own lifelong learning, which is also bound up with globalisation and change. Personal mastery is grounded in competence and skills but goes beyond them in a creative way. Senge (1990:141) links personal mastery with the ability to clarify personal vision and to see reality objectively, thus presupposing that there is an objective reality. The second relevant discipline is that of mental models, the ingrained assumptions, generalisations or pictures that influence how we understand the world. This is where Senge's (1990) ideas link to those of Argyris and Schön (1978) but Senge (1990) argues that we need to surface and scrutinise these mental models. They may be simple generalisations or complex theories, theories-in-use rather than the espoused theories (Argyris and Schön, 1978). Entrenched mental models will thwart change but improved mental models come from shared understandings of interrelationships and patterns of change. The third of Senge's (1990) disciplines relevant to the research study is team learning:

> '...the capacity of members of a team to suspend assumptions and enter into a genuine 'thinking together...' (Senge, 1990:10).

This suggests that learning takes place in a social context, discussed in the next subsection of this chapter.

A second influential work in the area of the learning organisation is that of Pedlar *et al* (1991), whose approach, unlike that of Senge (1990), is rooted in the practical, almost the prescriptive. They define a learning company as:

> '...an organization that facilitates the learning of all its members and continuously transforms itself...' (Pedlar *et al* 1991:1)

Their preference for *company* over *organisation* is based in their interpretation of the word company in the sense of conviviality rather than that of a legal trading entity. I feel that this interpretation is open to criticism, as it apparently excludes not-for-profit organisations such as local authorities, hospitals and universities. Pedlar *et al* (1991) describe the characteristics of a learning company in terms of a number of features that indicate its ability to learn from and respond to environmental changes, to understand the implications of rapid technological, economic and cultural change, and engage in learning to enable it to cope with and influence change. While these features are more immediately identifiable than Senge's (1990) five disciplines, the overall approach of Pedlar *et al* (1991) is situated in the literature of Organisational Behaviour and Human Resource Management, providing a recipe for success for a learning organisation. Notably, they distinguish formal training, '...the recognition of increased competence...', from informal learning, '...the less significant updating of older skills...' (1991:115). However, they were writing at a time when informal learning had not achieved the prominence that it now has.

There are two potential problems with the idea of the learning organisation. First, notions such as shared vision or transformation in response to environmental change seem to belong only to the world of the large corporate organisation. Matlay's (2000) two-year study of 6,000 UK SMEs

(small and medium enterprises) found that only a minority managed new knowledge strategically in order to promote and sustain competitive advantage. The second potential problem is that the idea of the learning organisation is presented as an unproblematic, good, desirable entity. This may not be the case, as it is not just the provision of learning opportunities but also the form and use of that provision that are the distinguishing factors of a learning organisation (Open University, 1996a). For example, it is easier and cheaper to provide at-desk training with an open learning workbook than it is to send employees on formal courses. The research study therefore needs to explore what provision for learning opportunities exists at Upworld to enable employees to cope with technological change.

The usefulness of the idea of learning organisation is that it brings us to the associated notion of organisational learning; indeed the two terms have been used interchangeably (Matlay, 2000:204). Easterby-Smith and Araujo (1999), however, distinguish two separate strands in the literature: that of the learning organisation, which is technical and more concerned with the quality of the learning process, and that of organisational learning, which is more social and theoretical, concerned with the process of individual and collective learning in organisations. They classify Argyris and Schőn (1978) and Senge (1990) among the technical approaches that view organisational learning as a response to the environment with the learning organisation as an intervention, the focus being on outcomes. For the remainder of this review I want to focus on the social and theoretical strand of the literature. In simple terms, organisational learning can be a matter of how people learn in the workplace and make sense of their experiences at work but there are a number of perspectives that are relevant here: those of workplace learning, informal learning, situated learning and apprenticeship.

Workplace learning

At the outset I want to make a clear distinction between the terms *work-based* and *workplace* learning because there is a lack of uniformity in the way that these terms are used in the literature. For example, Evans and Rainbird (2002:10) include in their mapping of the field of *workplace* learning, non-formal *work-based* learning, that is, initial vocational education:

> '...embracing learning through work and community experience, but [which] may also include planned and explicit approaches to learning carried out in any of these environments...' (2002:10)

Similarly, Raelin (1998) presents a model of management training that he describes as work-*based* learning in the Journal of Work*place* Learning. The term work-based learning has gradually become established in Higher Education as descriptive of the vocational elements of some degree programmes (Gallacher and Reeve, 2000). In this review I have interpreted work-based learning in line with Boud *et al's* (2001) definition as:

> '...a class of university programmes that bring together universities and work organizations to create new learning opportunities in workplaces...' (2001:4)

Using this definition, work-based learning is not a term that is relevant in this study. I shall use the term workplace learning to refer to the aspects of learning in the workplace that this review covers.

There is no universal model for learning at work but as the workplace increasingly becomes acknowledged as a crucially important site for learning (Evans *et al*, 2002:1), more attempts have been made to define workplace learning. Approaches in the literature may take the adult education perspective of the workplace as a site for informal learner-centred practice or the Human Resource Management perspective of training and effectiveness, (Hager, 1999; Fuller and Unwin, 2002). However, the notion of the workplace is itself problematic, (Fuller and Unwin, 2002). Matthews (1999), writing from the perspective of the discipline of management

studies, rightly points out that the workplace is not just a physical location but includes

> '...shared meanings, ideas, behaviours and attitudes which determine the working environment and relationships...(1999:19)

This view of the workplace suggests that learning from other people may prevail because, although some knowledge is embedded in the activities of the organisation, much is located in the individuals, (Eraut *et al*, 1998). It also suggests that the boundaries between learning at and for work, and at and for leisure, may be permeable. It may be that employees develop skills that spill over into their personal lives, that learning and work are no longer distinct (Boud and Garrick, 1999).

Fuller and Unwin (2002) summarise five models of workplace learning: transmission, competence-based, activity theory, informal learning and social learning. The transmission model relies on formal training structures that Fuller and Unwin (2002) associate with Taylorist approaches to work organisation referred to earlier. The competence-based model stems from the outcomes-based approach of Jessup (1991) and the development of the system of National Vocational Qualifications (NVQs). Activity theory is based on the work of Engeström (2001), which recognises that learning takes place in social situations but includes a place for structured teaching and learning. Discussion of Fuller and Unwin's (2002) two remaining models, of informal learning and social learning, are developed further in this review. Informal learning is associated inter alia with the work of Eraut *et al* (1998), Garrick (1998) and Marsick and Watkins (1990), and this discussion is developed in the next subsection. Social learning is exemplified in Lave and Wenger's (1991) theories of communities of practice, discussed in a later subsection of this review.

Earlier in the review I noted that one problem with the idea of the learning organisation is that much of the literature assumes that learning is a good thing, to be welcomed in the quest for either competitive advantage for the organisation or personal development for the individual. Similarly, the

literature reviewed by Fuller and Unwin (2002) assumes that workplace learning is an unproblematic good thing. However, there are dissenting voices. Workplace learning has been described pejoratively as an underground economy (Sawchuk, 1997) and as invisible training (Marconato, 1998). Sawchuk's (1997) study is of particular interest because it looks specifically at computer learning amongst industrial workers, although both the geographical setting (Canada) and point of comparison (unionised and non-unionised workers) are different from those of the research study. His paper focuses on the elements of power, surveillance and control. In his qualitative, interview-based study he found differences between unionised and non-unionised sites. The non-unionised workers learnt informally, while the unionised workers had more formalised opportunities and were better able to expand upon their learning. He concludes that support for informal workplace learning is questionable because of the potential for increased managerial surveillance over workers. My view is that we are right to be cautious, not for the reasons offered by Sawchuk (1997) but because support for informal workplace learning may change its nature and make it less informal.

It has been impossible to present this overview of the literature of workplace learning without using the descriptor *informal*. The next subsection therefore focuses on this informal aspect of workplace learning.

Informal learning

One model of workplace learning identified by Fuller and Unwin (2002) is that of informal learning and again, attention needs to be paid to how this and other terms, *non-formal* and *formal* learning, are used in the literature. An initial distinction that I want to clarify is that between informal *learning* and informal *education*. The latter is used to denote education in settings such as community and youth groups (Jeffs and Smith, 1996; Richardson and Wolfe, 2001) and is concerned with delivery from the educator's perspective rather than the learner's. This review does not therefore cover informal education.

Sawchuk's (1997) paper, referred to earlier, briefly distinguishes formal, non-formal and informal learning. A recent consultation paper by Colley *et al* (2002) analyses the literature that attempts to define informal learning, noting that writers may also use the various terms without clear definition, or address the issues without using the terms. My own review now presents the literature as concerned variously with definition, with the process that constitutes informal learning or with recognition of informal learning.

In terms of definition, the word *informal* may be set in opposition to *formal* or may carry connotations of the casual or incidental. Marsick and Watkins (1990), for example, in their influential work, take the latter view, regarding workplace learning as a by-product of other activities. Colley *et al* (2002) categorise the work of Marsick and Watkins (1990) along with that of Stern and Sommerlad (1999), as defining the terms along a continuum, while other writers give separate definitions of formal, informal and non-formal learning. Eraut (2000:12) suggests that non-formal learning is the more useful term, since this will distinguish it from the casual or incidental, and indeed this is the term that Colley *et al* (2002) adopt in their title. From the contextual perspective, Smith (1999) uses *formal* to denote learning within an educational environment such as a school or college, *non-formal* to denote learning within a community group or similar organisation and *informal* to denote what is left. Eraut (2000) rejects informal as a descriptor on the grounds of its connotations with other aspects of life such as references to dressing informally for social functions, and he defines non-formal learning by what it is *not*, by the residual nature of whatever exists when defining factors of formal learning are not present. Some commentators find the use of terms such as formal or informal unhelpful to the debate, and prefer not to use them (Billet, 2002), but I feel that Colley *et al* (2002) overstate their case when they say that this denies the existence of informal learning.

Attempts at defining informal learning are not new, as Colley *et al* acknowledge (2002:7), and perhaps too much can be made of these attempts. My preference is for an interpretation in the work context that

contrasts the learning with formal provision, such as in-company training or sponsored external courses. It is the learning that takes place amongst friends and colleagues in their everyday interactions and in the personal learning that an individual may undertake. Eraut's (2000) classification, despite its emphasis on what *is not* rather than what *is*, has the merit of advancing the debate to a consideration of the possibility of a process of informal learning.

Eraut's (2000) typology separates implicit, reactive and deliberate learning *processes*, each stimulated by a past, present or future experience. These form a continuum from non-conscious learning, through learning that occurs in response to situations, to conscious learning for which time is allocated, with planned learning goals. The process of informal learning might also be viewed from the perspective of the setting or context; it is learning that does not take place in a formal setting, whether that setting is the classroom or the company training room. The setting for this research study is the workplace but it will be useful to ask whether there is any transfer of learning between work and home. If learning begins in the home setting, the process may be that of self-directed learning, a concept within adult education that is linked to Knowles' (1975) theory of andragogy, supported by empirical studies such as those of Tough, (1979, 1993). Knowles' (1975) theory has been the subject of criticism (Davenport, 1993), and Tough's (1975) research can be criticised for its narrow, middle-class, North American setting, but there is no doubt that self-directed learning happens in a process in which:

> '...individuals take the initiative, *with or without the help of others*, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes...'
> (Knowles, 1975:18 my italics)

It could be said that anyone who has ever had a problem with a computer does this. This definition is noteworthy in that it suggests that learning does not necessarily involve interaction with others, although of course it may

(Eraut *et al*, 1998). This interaction is essentially dialogue or conversation, and it may be that this is where real learning takes place, rather than in delivered training that conveys dominant organisational values (Valentin, 1999) and is linked to business objectives. Eraut *et al's*, (1998) study was based on interviews with people operating at professional, managerial or technician levels in engineering, financial services and healthcare sectors and found, inter alia, that respondents referred to technical experts for advice, engaging in ongoing forms of consultation. However, the nature of informal learning at work may differ between the large organisations in Eraut *et al's* (1998) study that have formal training procedures, and those that are smaller and less structured. The present study extends and modifies Eraut *et al's* (1998) approach by the inclusion of all levels of the workforce and concentrating on one company.

Another process model of workplace learning is that based on:

> '...a community of practice (that is authentic, embodied work)...a dynamic...engagement with diversity, power and a variety of discourses...a context that is well-integrated with the wider environment...' (Beckett, 2001:154)

There is a connection here with Lave and Wenger's (1991) work on situated learning, discussed in the next subsection.

A further preoccupation of much of the literature on informal learning is with recognition, for example, by bringing informal learning under the banner of organisational provision. Eraut *et al* (1999), for example, emphasise the importance of managers in the creation of a climate that will support informal learning. This suggests possibilities for the breakdown of some of the boundaries of adult learning. For example, greater recognition of informal learning could mean increased inclusion for those who develop their skills outside work (Marsick and Watkins, 1990), and it could provide guidance to policy-makers (Eraut *et al*, 1998). From this perspective, recognition is something that would be regarded by many as positive.

However, the wisdom of breaking down these barriers has been questioned. Hillier and McGill (2001) ask whether we are right to:

> '...step over the boundary between public and private learning ...' (2001:189).

They, like Sawchuk (1997:403), warn that to formalise informal learning may carry with it the potential for increased scrutiny of employees by management and thus loss of worker control.

Informal learning is said to be difficult to organise and control (Marsick and Watkins, 1990), and it cannot be measured by qualifications and participation rates (Gorard *et al*, 1999). However, this begs the question of why it has to be controlled at all, why it has to be recognised. I would agree that there is a danger that if workplace informal learning were to be ignored, the resultant form of lifelong learning would exclude those who do not have access to provision in the workplace or who do not have access to work at all. However, I would also argue that even if the discourse of government policy does ignore informal learning, it will still go on. People will not cease to be autodidacts because their learning is unrecognised by government. Gorard *et al* (1999) say that they are trying to rescue informal learning from the dominant discourse of human capital but one could question why it needs rescuing. Employers may depend on it wittingly or unwittingly, but to deny that they do is to create a further boundary at the factory or office door, since people may wish to bring into the workplace the knowledge and skills that they have gained outside work. It may be that in the context of computer skills it is difficult to provide formal opportunities for all the learning that is necessary in order to become literate. The study will, in part, explore to what extent the company has facilitated an environment for informal learning, where people have the time and space to learn from each other, and to what extent this has happened without being facilitated by the company.

Coffield (2000:8) argues that informal learning needs to be seen as fundamental, necessary and valuable in its own right, sometimes relevant to employment, sometimes not. His assumption is that informal learning

should no longer be regarded as inferior, but this begs the question of when it *has* been regarded thus. It was certainly not seen as inferior in the South Wales coalfields (Gorard *et al*, 1999) where it was a major means of transferring skills. The concern in the literature for recognition of informal learning seems to have no consistent underpinning reasoning. Garrick (1998:5) points out that what shapes informal learning at work is more interesting than questions of quantifying or assessing it, although from the perspective of the HR practitioner, this shaping is done by market forces. Perhaps the important point is not the recognition of informal learning from a policy-maker's or provider's perspective, but its evaluation (Alheit, 1999) and its recognition by managers and employers, reflected in rewards and employability (Stevens, 2000).

Informal learning at work is also shaped by the individual's experiences at work, so the review will now briefly explore the term 'experiential learning'. The term can be used, as it is in this review, simply in the sense of learning from and through experience in everyday contexts (Usher, 1993), but the term has been problematised and is open to interpretation. One view in the literature is of experiential learning based in reflection, a view found in what many regard as the seminal work by Kolb (1984). Kolb's (1984) analysis proposes a model of a learning cycle used as the basis for a typology of learning styles and structures of knowledge in academic disciplines. Kolb's (1984) work has been heavily criticised on several grounds (Jarvis, 1987; Tennant, 1997; Miettinen, 2000). From the perspective of this research study, the most serious criticism that can be made of Kolb (1984) is that he has a limited concept of experience as a particular incident in time, ignoring cultural and social processes of learning from experience. Observation of experience is a starting point for knowledge but this may not be objective, since observation is guided by cultural expectations and prior conceptualisations; it takes place in an activity or context. The contextual and socio-cultural aspects of observation and of learning that are absent from Kolb (1984) are to the forefront in the literature of situated learning, to which the review now turns.

Situated learning

Situated learning is part of a perspective that emphasises the social and contextual rather than the individual and the psychological. It is a model of learning in which knowledge is built up in social settings, rather than acquired in the abstract, out of its context (Evans and Rainbird, 2002:17). Theories of social learning seem to reverse those of experience and reflection by placing the context rather than the learner at the centre (Open University, 2002). The seminal work here is that of Lave and Wenger (1991) who, by challenging individual views of learning and teaching, present an antidote to the discourse of individual responsibility (and thus blame) for learning that runs through much government rhetoric. They base their theory of situated learning on a number of case studies of geographically diverse groups: Yucatac midwives, Liberian tailors, American naval quartermasters, butchers and one non-occupational group, members of Alcoholics Anonymous. The central argument of the theory of situated learning, summarised in the foreword to their work (Lave and Wenger, 1991:1-24), is that accounts of learning hitherto had ignored its social character, that learning is a process of participation in a community of practice, at first peripheral then gradually increasing in both engagement and complexity. The defining characteristic of their argument is the idea of legitimate peripheral participation (Lave and Wenger, 1991:29), which they developed from the notion of apprenticeship:

> '...We and our colleagues had begun to talk about learners as apprentices, about teachers *and computers* as masters, and about cognitive apprenticeship, apprenticeship learning and even life as apprenticeship. It was evident that no one was certain what the term meant...' (Lave and Wenger, 1991:29, my italics).

Lave's (1997) work with the Vai and Goan tailors in Liberia suggested a connection between apprenticeship and legitimate peripheral participation but she found difficulty in separating the historical/cultural circumstances of the communities from the educational model of apprenticeship used therein. She remarks that research into practice focuses on activities that cannot be analysed in isolation from the material world of the activity:

> '...learning [is] ubiquitous in ongoing activity, though often unrecognised as such...' (Lave, 1993:5)

Although participation in the community of practice involves acquiring knowledge by practice, Lave and Wenger (1991:31) specifically distinguish their theory from 'learning by doing'. Newcomers to the community learn on the periphery, hence the term 'legitimate peripheral participation', and move towards mastery and full participation through social interaction, (Lave and Wenger, 1991:29). The theory shifts first of all from the historical notion of apprenticeship to that of situated learning, becoming a general theoretical perspective rather than being located in space and time. It shifts a second time from situated learning to legitimate peripheral participation in order to encompass the notion of engagement in social practice. The term *legitimate peripheral participation* is not decomposed into its constituent words, rather it is taken to refer to a place or situation from which the learner can move to more intensive participation.

At first sight, this seems an attractive idea that might underpin this research study. If computer users who are not IT specialists can be regarded as a community of practice, then learners may initially take the role of legitimate peripheral participants and subsequently move to greater levels of participation. The question therefore arises of whether I can argue that computer users are a community of practice. Four of the five groups that Lave and Wenger (1991) describe are specialist occupational groups, implying that knowledge only has validity within such a group. However, their inclusion of Alcoholics Anonymous suggests that their theory is applicable not only beyond a specific work setting, but also beyond the workplace. This is helpful for the research study, which explores learning across all the occupational groups of one workplace. Ball (2003) has used the notion of the community of practice to examine trade union education, and asks whether the learning that is central to a community of practice renders it a community of learners. He refers to the '...mutual engagement...' (Ball, 2003:301) of occupational groups including the example researched by Wenger (1998) of insurance claims processors. Ball

(2003) finds the inclusion of Alcoholics Anonymous significant because this enables us to conceptualise the community of practice as one of people whose shared activity is based in an orientation rather than an occupational task. This would support the argument that the computer users in my study are a community of practice. Mayes (2002) extends the idea of situatedness by suggesting that it can be considered at three levels: the social-anthropological level of Lave and Wenger (1991), the learning group level where learning is situated in a class or tutorial group, and the level of individual relationships within communities. It may be that the situatedness of learning to use computers is at this third level.

Situated learning is not without its critics. Tennant (1997:73-79) points out that Lave and Wenger (1991) fail to address a number of issues in their work:

> '...power relations, access, public knowledge and public accountability...' (Tennant, 1997:79).

It may be, for example, that access is denied or restricted to communities dominated by a single gender or race. Formal education and accreditation provide such points of access and also a measure of transferability. Communities of practice may be so closed that they contain secrets that can only be gained by legitimate peripheral participation, or they may include formal education as part of their practice and a condition of legitimate peripheral participation. In my view, much of Tennant's (1997) criticism is incorrectly based on the assumption that Lave and Wenger (1991) argue for the exclusivity of situated learning. They do not say that situated learning and legitimate peripheral participation are the *only* means of learning; they simply wish to address the perceived neglect, in cognitive theories of learning, of the social nature of learning. It is the case however, that Lave and Wenger (1991) offer no analysis of how communities respond to social and technological change, where new entrants to the community

> 'may have knowledge and access to new technologies which will displace traditional methods of practice...' (Tennant, 1997:79).

This is particularly relevant in the context of computers where the technology constantly changes. It is also the case that Lave and Wenger (1991) do not address power relations in communities of practice, again, something that may have resonance in the context of computers if perceptions of computer literacy involve empowerment through, for example, programming as the means of mastery of the machine.

More recently, Wenger *et al* (2002) have attempted to operationalise situated learning theory by developing a set of principles for the 'cultivation' of communities of practice within an organisation. These principles attempt to encourage vitality as an indicator of the success of a community of practice, and one relevant focus is on value. By this Wenger *et al* (2002:59-60) mean that value in the community at an early stage comes mainly from a focus on current problems and the need of the community's members to develop a systematic body of knowledge:

> '...many of the most valuable community activities are the small, everyday interactions - *informal* discussions to solve a problem...' (Wenger *et al,* 2002:60, my italics).

Wenger *et al* (2002) then provide a series of prescriptions for communities of practice based on developmental stages that seem similar to Tuckman's (1965) stages of group formation. Wenger *et al's* (2002:69) stages are: the initial stage of discovery; coalescing, where ideas incubate; maturing, where the community can focus and expand; stewardship, the plateau stage of development; and finally transformation, in which the community may let go of its knowledge, work and ideas. Finally, Wenger *et al* (2002) provide advice for each stage of development that relates to three categories of issues that can occur: domain issues that define scope, community issues that involve finding people who can network on the topics under discussion and practice issues relevant to identifying common needs. Although I could recognise something of relevance to the study in their descriptions, Wenger *et al's* (2002) work seems too reminiscent of management consultancy literature in its attempt to provide a 'recipe' for success. Its focus is essentially on learning for organisational benefit, while at the same time trying to develop a pedagogy of community practice. Also, the communities

upon which it focuses are networks of professionals defined by their occupation.

I noted earlier that Lave and Wenger's (1991) work developed from a reconceptualisation of apprenticeship. The literature review now concludes with a brief overview of ideas of apprenticeship and mentoring that can, like situated learning, provide a more social perspective of learning than transmission models.

Apprenticeship and mentoring

Apprenticeship has in the past been associated with a particular type of employment contract whereby young people learnt a trade or skill. It combined legal and contractual rules relating to employment, workplace entitlements and formal and informal education (Guile and Young, 1998). Its pedagogical practices involved the learning of skills through practice, observation and participation, (Wolek, 1999). Commentators such as Guile and Young (1998) and Fuller and Unwin (1998) have drawn variously on new interpretations of both Vygotsky's (1978) idea of the zone of proximal development, Lave and Wenger's (1991) theory of situated learning and Engeström's (2001) activity theory to argue that apprenticeship can be reconceptualised to provide a basis for a more inclusive social theory of learning.

Two reservations about the situated learning theory of Lave and Wenger (1991) that are relevant to this research study are expressed by Fuller and Unwin (1998:160). First, they question the extent to which the natural forms of apprenticeship of the examples that featured in the research of Lave and Wenger (1991) can be generalised. This is important because my research study is not concerned with a community as historically, culturally or occupationally bounded as those of Lave and Wenger (1991) but with people across occupational groups, connected only by their workplace. Second, Fuller and Unwin (1998:160) point out that situated learning theory tends to downplay the role of the teacher in the community of practice. This

element is, however, present in activity theory, Engeström (2001) and in notions of apprenticeship that direct attention both to the context of learning and to the role of the teacher. A useful idea comes from Zepke and Leach (2002) who use the term 'contextualised meaning making' to extend individualised approaches to learning. This involves learners being connected in some way to others, and to a teacher in the form of another more knowledgeable learner who encourages a new way of interpreting their experiences. This suggests an extension of the master/apprentice model to that of the learner/mentor.

Roberts' (2000) review of the literature of mentoring settles on the following definition:

> '...A *formalised* process whereby a more knowledgeable and experienced person actuates a supportive role of overseeing and encouraging reflection and learning within a less experienced and knowledgeable person, so as to facilitate that person's career and personal development...' (2000:162, my italics)

This seems too restrictive, especially if mentoring is to be considered in the context of informal leaning. A more appropriate definition in the context of informal learning is that of Alred and Garvey (2000):

> '...A nurturing process in which a more skilled or experienced person, serving as a role model, teaches, sponsors, encourages, counsels, and befriends a less skilled or less experienced person for the purpose of promoting the latter's professional and/or personal development...' (2000:263)

Both these definitions refer to a process, whether formalised or nurturing, but what is significant for the research study is the role of the more skilled or knowledgeable person. Mentoring can aid professional development (Evans and Rainbird, 2002:18) and much of the literature from the discipline of Human Resource Management contextualises it as a process for professional groups, but the mentor role may be crucial in the strategies that people use to acquire computer skills at the most basic level. It may

offer a model that could serve as an alternative both to communities of practice and to the more formal notions of apprenticeship.

Summary

The literature review has surveyed sources from a number of disciplines to illustrate key themes for the empirical study that are reflected in the research questions. The first research question asks how computer technology has affected individuals in the workplace in terms of work itself and the way they work. The review of the literature relating to the changing world of work suggests that it would be wise to be critical of theories of a new world of knowledge workers and symbolic analysts (Reich, 1992), and that we are more likely to be in a neo-Fordist model of insecure, low-skilled employment (Brown and Lauder, 1999). The empirical study will therefore ask the respondents what they do with a computer at work and what computer skills they think that they need.

This leads to the second research question, which asks what individuals think computer literacy means for them and what they think about the computer. The related literature over a period of time has suggested many definitions and typologies (Bostock & Seifert, 1986; Johnson & Eisenberg, 1996; McMillan, 1996) moving into alternative definitions of newer forms of literacy (New London Group, 1996; Lankshear, 1998). The study will explore how people regard their own computer skills, or lack of them, and what it means to them to be computer literate. The review has not explored the literature relating to affective factors, as this is largely contained within the discipline of HCI studies, where the perspective is psychological and the studies are aimed at improving person-machine interfaces. However, affective factors were thought to be important at one stage in the debate concerning computer literacy (Bostock and Seifert, 1984), so the second research question is extended to ask how people feel about computers.

Computer skills are inextricably connected with learning, so the third research question asks how people learn to use computers. The review here

began with the idea of the learning organisation (Senge, 1990; Pedlar *et al*, 1991) and focused on forms of organisational learning. Crucial to this question is the exploration of how much informal learning of computer skills takes place in the workplace and what learning opportunities are provided. This gives rise to an additional research question of whether learning is transferred in any way between home and work or whether the learning is bounded by the work situation. The literature suggested a number of models for exploration, notably that of the community of practice from Lave and Wenger's (1991) theory of situated learning. The empirical study is not one of an occupational group but of computer users across a number of such groups. It may be that other models for the pedagogic practices that take place are more appropriate, for example, a form of apprenticeship, (Fuller and Unwin, 1998) or of mentoring (Garvey, Alred and Smith, 1996). This review has not taken an extensive account of the literature of either apprenticeship or mentoring but the empirical study will indicate this as a future avenue of research.

The next chapter of the dissertation sets out the methodological approach to the study and describes the methods used to explore the research questions.

Chapter 3 Methodology

Introduction

Research reports such as this dissertation inevitably make both implicit and explicit claims about knowledge. As a researcher, I have made a number of choices during the progress of the research study about the methodological approach, methods, research instruments and the site of the study. This chapter presents the justification for these choices. The first subsection presents a discussion of research methodologies and the argument is made for an interpretive stance. This is followed by an overview of the qualitative/quantitative debate. Subsequent subsections argue for the use of survey and case study approaches, using questionnaire, interview and diary methods. Finally, ethical considerations, including those relating to the site of the study, are discussed.

The empirical research was carried out in two phases so the practical issues such as instrument design and piloting, and sampling strategies, are discussed at appropriate points in chapters four and five.

Methodological approaches

The literature of research methodology is vast and various, covering a range of philosophical and epistemological questions as well as technical matters of research design and data analysis. It encompasses the different paradigmatic approaches to research (Scott, 1996; Usher, 1997; Guba and Lincoln, 1998) and it deals with the quantitative/qualitative debate (Hammersley 1992; Bryman 1988). At a different level, there are less reflective but far more practical works (Oppenheim, 1992; Bell, 1993; Cohen and Manion, 1994; Blaxter *et al*, 1996). I shall draw on all of the above but necessarily can only summarise what is a vast area.

At the outset of the research study I felt a false confidence that exploration of my approach was in some way unnecessary; after all, I wanted to explore

what people thought about something so this would naturally lead to certain approaches and methods. However, part of the research experience is to problematise the apparently unproblematic, so it became important to scrutinise the possible approaches to my research. The literature does not, however, have a consistent way of referring to these approaches. For example, Guba and Lincoln (1998) refer to paradigms of positivism, post-positivism, critical theory and constructivism, Scott (1996) to positivism, post-positivism, and interpretive/hermeneutics, and Denzin and Lincoln (1998) to positivism, post-positivism, postmodernism and post-structuralism. These differences suggest that an approach may not easily fit a category.

The positivist approach to research is associated with concepts of scientific knowledge and the search for truth. It assumes that there is an objective reality, independent of the researcher (Usher, 1997). The criteria for evaluating such research are first, internal and external validity, that is whether the research report corresponds to reality, and second, objectivity in that the researcher's own views have been eliminated. My problem with positivism is that I cannot eliminate myself from the research, nor do I believe that there is an objective reality independent of me as the researcher. Although positivism is still a powerful approach, not least with those who have attacked educational research recently (Tooley and Darbey, 1998), there are alternative frameworks and understandings. I want to look, briefly, at interpretivism, critical theory and postmodernism.

The interpretivist approach seeks to understand the world differently, looking at how individuals create meaning in their lives. There are different strands within this paradigm: phenomenology, hermeneutics and constructivism. Knowledge is seen as subjective, socially constructed; the approach involves the:

> '...fundamental assumption is that different individuals understand the world differently...' (Foley, 2000:19).

The interactions of people with the world are mediated through language. A key concept of interpretivism is that of the double hermeneutic (Giddens

1984) whereby, because people both generate and are influenced by social scientific descriptions of social processes, the researcher's explanations of the social world are fed back and incorporated into the construction of meaning, which is thus amended or changed. If these new elements make the original explanation redundant, then it is argued that the researcher using this approach cannot make predictions. However, this criticism does not allow for the researcher who, like myself, would not want to take a predictive stance. Critical theory moves the emphasis of research from the individual to the context, focusing on the relationship between knowledge, power and ideology. Critical theorists have some agenda or aspirational stance; the researcher brings to the research setting theories about the world, and a desire to change it. Postmodern approaches to research challenge all positivist or empiricist approaches that are based on neutral observation, the separation of researcher from context or the independent existence of data that is capable of analysis (Usher, 1997). This approach, if indeed it can be called an approach, attempts to bring to the fore the power-knowledge relations that exist. Knowledge is generated through language and the production of texts and it is always '...partial and perspectival...' (Usher, 1997:31); accounts are created by the writer and interpreted by the reader. Postmodernism is at the other extreme from positivism in denying the possibility of objective truth or knowledge. This seems to me to be rather defeatist for a researcher, since it implies that there is nothing to research, or that research as the task of producing knowledge cannot be taken seriously (Hammersley, 1999). This is what Silverman (2000:39) calls '...a nihilistic denial of content...' Perhaps a more constructive criticism is that of Usher (1996a) who says that postmodernism:

> '...reflects the contemporary decline of absolutes and a questioning of the belief that following the correct method guarantees true results...' (1996a:25)

Postmodernism does not deny research but calls for less certainty, perhaps the 'fuzzy logic' of Bassey (2001) that I refer to later in this chapter.

The differing approaches seem incapable of resolution but in clarifying my approach, I first considered three questions posed by Guba and Lincoln

(1998:201). The first (ontological) concerns the form and nature of reality and what can be known about it. I would argue that reality is as someone sees or knows it, by observation, reading and experience. This confirms my rejection of any positivist view of the existence of one reality, knowable by all, and of objective facts to be discovered by rigorous enquiry (Arksey and Knight, 1999). The second question (epistemological) concerns the nature of the relationship between the researcher and what can be known. Both my response to the ontological question, and my concern in the research study with people's interpretations, lead me to reject any stance as a detached observer of an objective reality. Guba and Lincoln's (1998:201) third question concerns how the researcher finds out what they believe can be known. I wish to explore perceptions, which cannot be expressed in numbers or by statistical analysis, so I am concerned with interpretation. My way of finding out is to ask people what they do and what they think; I am listening to people because I am interested in how they perceive their learning, in a narrative, subjective way and they will not be objective about this. Thus neither observation nor experiment, which imply an objective world, would provide this.

In order to confirm the paradigm that informs my approach I considered Scott's (1996) analysis, which seems clearer than that of Guba and Lincoln (1998). He contrasts three research strategies: experimental (positivist), survey (post-positivist) and hermeneutic/interpretive. Although my use of a survey would seem to belong to the post-positivist rather than the interpretive approach, I argue later that my use of a survey as a *method,* is not incompatible with an interpretive *approach.* Scott's (1996) definition of the research paradigm helps to clarify this. It is:

> '...a distinct way of approaching research with particular understandings of purposes, foci, data, analysis and more fundamentally, the relationship between data and what they refer to. Thus different and contrasting methodological frameworks may embrace the same data collection method...' (Scott, 1996:61)

The contrasting frameworks would collect different types of data in different ways. The core of this research study is an exploration of how people learn to use computers and what they think is meant by the notion of computer literacy. These notions are clearly not the absolute 'truth' and thus any positivist approach to this study would be unsuitable. Also, I have no theory or hypothesis at the outset that I want to test against data. The relationship between theory and research may be deductive or inductive; mine is the latter. The positivist approach views research as capable of establishing the 'truth' but this would only be so if language conveyed meaning with transparency. The term *computer literacy* clearly does not convey a transparent truth if there are different constructions of it. Also, I cannot label the research from any kind of aspirational viewpoint. The study is concerned with an exploration of notions and conceptualisations so the approach is one that begins at least in the interpretive paradigm, and, using Blaxter *et al's* (1996) classification, will employ a mix both of approaches and instruments. I am thus aiming for the type of triangulation classified by Denzin (1978) as methodological, that is, the use of multiple methods to study a problem.

One further issue arising from the methodology literature is that of the reflexivity and textuality, (Usher, 1996b). Rejecting as I have a naïve, realist view of research, I am positioned within a framework of understanding that is almost autobiographical, in view of my own attempts at computer learning. Thus mine is not a realist text: the linear presentation inevitably has confessional overtones. Usher (1996b) distinguishes the *written* 'I', the researcher's presence via language, discourse and interpretative culture, from the *inscribing* 'I', the self-present, autonomous author. As the inscribing 'I', I selected the research topic out of fascination with people's attitudes to computers. The written 'I' created the research text, using a computer, and writing much of the report in the first person. It would be dishonest to attempt to disguise either presence.

The quantitative/qualitative debate

Classically, quantitative research is associated with the search for causal relationships, the use of standardised research instruments and the analysis of data using statistical techniques (Open University, 1994, 1996b). Qualitative research is associated with a focus on natural settings, perspectives, meanings and understandings, and an emphasis on process and the analysis of data using inductive methods such as grounded theory (Strauss and Corbin, 1990; Open University, 1994, 1996b). Implicit in many descriptions is a *contrast* between the approaches rather than a comparison. For example, Bell (1993:5-6) contrasts the collection and study of facts with the aim of producing quantified and generalised conclusions (quantitative research), with the desire to understand the individual's perceptions of the world (qualitative research). Hakim (1987) similarly contrasts qualitative research and surveys, the latter offering a macro view, the former a micro view of the world. Often the difference between quantitative and qualitative research is presented as one of a simple choice between approaches or methods without the distinction being problematised (Bell, 1993; Blaxter *et al*, 1996), but I agree with Usher and Bryant (1989) who deny that circumstances are given such that an automatic choice of method would follow.

In much of the literature there seems to be an in-built assumption that quantitative and qualitative approaches *are* different and that their differences render them mutually exclusive. Sometimes the language of the debate is extreme: the '...ideological war zone...' of Sanders and Liptrot (1993:1) or the '...violent...' quantitative approach of Reason and Rowan (1981:487); sometimes the language simply seems strange. For example, Burgess (1985:1-3) uses terms like *soft*, *dry* and *fluid* to characterise qualitative research, and *hard*, *wet* and *fixed* to describe quantitative research. He does not explain what wet data is, but does present four characteristics of qualitative research: the researcher works in a natural setting; studies may be designed and redesigned since methods are flexible; the research is concerned with social processes and with meanings that participants attribute to social situations; and data collection and analysis

occur simultaneously, with theory emerging from the analysis. This last point could almost be a description of grounded theory (Glaser and Strauss, 1967). However, none of these are necessarily unique to qualitative research and they can, with some adjustment, be applied to quantitative research. Also, to say that theory emerges from analysis of data would seem to imply, wrongly in my view, that qualitative research begins as an aimless desire to collect information. This is one of Silverman's (2000) objections to the view that quantitative and qualitative approaches are distinguished by the presence (or not) of a presumed theory and the degree of tightness of the research design. I wholly support Silverman's (2000) view that:

> '...The beauty of qualitative research is that its rich data can offer the opportunity to change focus as the ongoing analysis suggests...(2000:63),

as this was certainly my experience during this research study.

The methods used in qualitative research include participant observation, unstructured interviews, life history and group discussion, but fundamental to the approach is the study of the social world, which attempts to analyse culture and behaviour from the viewpoint of the people being studied so that the researcher can see '...through the eyes of...' (Bryman, 1988), a perspective that is not entirely without its problems. Hammersley (1999) warns against treating data in qualitative research as a source of illustrative examples, what Silverman (2000) calls the anecdotal approach. The preference is for engagement with the data to explore the meanings it *could* carry, something that I hope to do in my analysis. Those who polarise the approaches (Sanders and Liptrot, 1993; Burgess, 1985) seem to see the difference as one between structure and chaos, outcome and process, the objective and the subjective and most basically, quantity and quality. These differences have an impact upon a number of areas: the role of the researcher, their relationship with the subject, treatment of data, the scope of the findings, the image of social reality, and even the purpose of the research.

The qualitative/quantitative debate concerns not only comparison and contrast, but also whether the two approaches can or should be used together. Some argue that to do so would be methodologically unsound, combining positivism with interpretation, facts with meanings, but such an argument assumes too readily that quantitative techniques have a place only in the positivist approach. As we have seen, Scott (1996) argues that different paradigms may use the same data collection methods, but in different ways and thus will collect different data. Also, Denzin's (1978) classification of triangulation includes the possibility of theory, methodological and data triangulation, as does that of Hammersley and Atkinson (1983). More recently, Denzin and Lincoln (2000) have used the concept of the researcher as a *bricoleur*, a maker of quilts or montages, whether methodological, theoretical, interpretive or narrative, to illustrate the multi-faceted, combinatorial nature of research.

Bryman (1988:104-118) questions whether the debate is one of epistemology or of techniques. If quantitative research is positivist then it seems to follow that the position is epistemological because research has to conform to scientific method. However, the debate could be viewed as one of the appropriateness of techniques to a particular problem. The importance of this distinction lies in the point that if the debate *is* epistemological then there is little hope for any combination of the two approaches, whereas if it is technique-based then there is this possibility. If, as practitioners rather than as philosophers, we view the debate as grounded in techniques then there are ways of combining qualitative and quantitative approaches. Qualitative research can act as a precursor for quantitative research, by producing a hypothesis that can then be tested using quantitative methods, or, as in this research study, quantitative research in the form of an initial questionnaire can be followed up by interviews of a qualitative nature. In a single piece of research it may not be possible to give equal weight to the two approaches, but it is neither necessary nor constructive to view this as a problem. It is more helpful to apply the distinction between the terms to the data itself, for example:

> '..qualitative data are data that cannot readily be converted to numerical values...' (Yin, 1993:57)

This is the approach used by Hawtin *et al* (1994) who refer to qualitative data that does not allow for statistical precision and 'hard' information that is simply that about which the researcher is confident. They raise an interesting point when they refer to people being deterred by statistics and wanting additional information to profile attitudes and beliefs, almost as though, for some, the qualitative data are *more* reliable. Statistics are attractive since they provide apparent law-like explanations and sustain the illusion of rigour and detached rationality. The problem with statistics is that they do not answer every question, so are therefore not sufficient. Smeyers (2001), in his discussion of causality in social explanation, expresses this clearly:

> '...because what people *generally* do in particular circumstances is not irrelevant either, quantitative research surely has its point. That this does not answer the question why people do what they do in terms of reasons, goes without saying - as *that is a different question*...'(2001:488, my italics)

Silverman (2000) questions the usefulness of the debate if:

> '...simple quantitative measures are a feature of some good qualitative research...' (2000:11)

With this in mind, I have used in my research study a combination of the qualitative and the quantitative, an example of which is found in Bird (1992). In the first phase of her study, which was concerned with the implementation of educational policy, a questionnaire was used, followed in the second phase with observation and in-depth interviews. Bird (1992) is very clear that she is employing a variety of methods and collecting quantitative and qualitative data. She relates the use of the different techniques to the logic of the study in each phase: the first phase was to gather basic information using the questionnaire, while the second was longitudinal, aimed at tracing policy objectives through to their

implementation, using interviews and observation. She also provides a careful explanation of how the two types of data were brought together. Bird's (1992) study shows both an effective combined use of qualitative and the quantitative techniques and a carefully thought out rationale for their combination in the same study.

Meanwhile, the qualitative/quantitative debate continues. Pring (2000) has suggested that the rigid distinctions made between qualitative and quantitative approaches are damaging to the educational community, a false dualism. Understanding educational practice requires careful analysis of the social situation: the rules, people's interpretations, values and aims. Thus Pring (2000) argues for a combination of approaches:

> '...The qualitative investigation can clear the ground for the quantitative-and the quantitative can be suggestive of differences to be explored in a more interpretive mode...' (2000:259)

Similarly, Smeyers (2001) argues that educational research must focus on both the mechanistic (what things are like) and the intentional (what they mean) aspects of human behaviour and therefore requires different research approaches. Educational research has come under criticism during the last decade (Hargreaves, 1996; Tooley and Darbey, 1998) so the debate does matter if qualitative research is to be judged on its ability to produce valid knowledge (Silverman 2001). Views of what constitutes valid knowledge differ, so it is vital to look at how knowledge has been constructed. I have amassed narrative data about the social world; it is value-laden but it can feed back to affect or change the social world. This kind of research can show that what we *think* is happening is neither the actuality nor the entirety of what *is* happening (Hammersley, 2000).

In summary, the distinction between qualitative and the quantitative research is often drawn too sharply. They are certainly different but they can be used in combination at different stages for different purposes: a methodological *bricolage*. Perhaps Oppenheim (1992) illustrates the

tensions best in his comment in the context of projective research techniques:

> '...There is often a painful conflict between the demands of objectivity, scientific method and rigour, on the one hand, and the desire to get the fullest flavour of meaning and significance out of such self-revealing responses on the other. We have not yet acquired methods that will allow us to do both. In making the choice of 'level', the social scientist faces a difficult task...small wonder then that some of us build our half-way houses a little further down the slope than others...' (1992 : 213-4)

The half-way house for this research study is not dissimilar to that of Bird (1992) and uses the methods of a questionnaire, semi-structured interview and respondent diary, discussed in a later subsection. Using this compromise, I shall not claim that my results are true in any absolute, positivist sense but I hope that they may be illustrative, illuminating, interesting and persuasive in their context.

The research approaches: survey and case study

The methodology literature, particularly that of the more practical type, distinguishes in some way the underlying approach, perspective or paradigm from the techniques or methods used. There seem to be several ways of doing this. For example, Blaxter *et al* (1996:58-59) divide methodology into research *families*, which are either quantitative/qualitative or deskwork/fieldwork, and the research *approaches*, which include action research, case studies, experiments and surveys. They reserve the term *method* for data collection tools or instruments: documents, interviews, observation and questionnaires. For me, the advantage of this classification is that it prevents any permanent associations or mappings. For example, the research approach of a survey may be carried out using any combination of documents, interviews, observation and questionnaires. Using this classification, the *approach* of my study is a blend of the survey with

elements of the case study, while the data collection *methods* are those of the questionnaire, the interview and a respondent diary.

The survey approach

Cohen and Manion (1994) describe the survey as:

> '...the most commonly used descriptive method in educational research...' (1994:83)

It is a means of collecting information by asking questions of members of a particular group, usually people but sometimes documents. The survey's distinctiveness lies in its simultaneous selection of naturally occurring cases, (Open University, 1996b). Many of the 'how to' guides on research give advantages and disadvantages of surveys, observations, experiments and so on, implying that the researcher has a free choice. This is not the case, since both the methodological approach and the topic will guide the researcher towards certain methods. As discussed earlier, I want to know what people think, I want to hear their stories, so a survey approach, using a questionnaire and interviews, rather than an experimental or observational approach is appropriate. Experiment and observation could tell me how people used their computers and enable me to make comparisons between groups to test the effect of variables that I might introduce, but this was not the purpose of my research study.

The case study approach

My research can be regarded as a case study in the sense that its context or site is a single company. The case study approach has the advantage of allowing a researcher the opportunity to explore one aspect or site in some depth, despite a limited time scale (Bell, 1993), using a mixture of methods (Blaxter *et al*, 1996). However, great care must be taken not to draw unfounded generalisations from the case.

Using Stake's (2000a) taxonomy, where an *instrumental* case optimises understanding of the issues that it exemplifies, as opposed to an *intrinsic* case study, researched for its own sake, or a *collective* case study involving a number of cases, I can argue that my research study is, in part, an

instrumental case study, since it involves exploring the learning and the constructions of computer literacy held by the employees of one particular company. The site of my research exemplifies issues of the use of computers, attitudes to them and to learning about them and the different perspectives of what it means to be computer literate. I am not primarily interested in gaining a better understanding of the company *per se*, but of the views held by its employees.

Stake's (2000a) is not the only taxonomy of case study types. Bassey (1999) gives an overview of a number of analyses but is unable to provide an overall framework on the grounds that he cannot be sure either that he has correctly interpreted what various writers mean by the terms that they have used, or that they are clear in their own minds about these terms. Hammersley and Gomm (2000) also problematise *case study* as a term because it is not used in a standard way in the literature and also has meanings outside research, for example, the cases dealt with by doctors and lawyers. They compare case study with experiment and survey approaches along several dimensions, highlighting the implications for research in areas such as the amount of detailed information, control of variables, the kind of data produced and issues of objectivity. My study treats the case as the boundary for the research; I could have chosen a different kind of workplace, perhaps a Higher Education institution, as the boundary. In this sense, the site becomes

> '...not a methodological choice but a choice of object to be studied...' (Denzin and Lincoln, 2000:72).

It is the context of the research study rather than a '...constituent member of a target population...' (Stake, 2000b:23)

Generalisability

The main issue of concern in the case study approach is generalisability, that is, whether a case study can be used to make generalisations about the wider world. Stake (2000b) says that the case study can have relevance, though it may not provide a sound basis for generalisation. Its strength is in providing vicarious experience, drawing the researcher towards illustrating how

concerns are manifest in the case. Using Polanyi's (1958) distinction between propositional and tacit knowledge, Stake (2000b) argues that the case study is advantageous when the research aims are understanding, extension of experience or increase in conviction, which are features more of tacit than propositional knowledge. Generalisability depends on the fit between the case studied and others to which the concepts and conclusions might be applied (Schofield, 1990). Three possible targets for generalisation are: what *is,* the typical, common or ordinary; what *may be*, future trends and issues; and what *could be*. Using this taxonomy I would argue that from my case I could generalise about what is and what may be.

The issue of generalisability from cases is further informed by Bassey's (2001) argument for the formulation of research conclusions using words like *could* and *may*, that he calls fuzzy predictions. This is a simple idea whereby a statement like '...x in y circumstances *results* in z...' becomes '...x in y circumstances *may result* in z...' (Bassey, 2001:5). Further, he suggests that the likelihood of z may be indicted by an estimate based on the researcher's professional judgement. Such a prediction must be supported by an account of the context of the statement and the evidence justifying it. The strength of Bassey's (2001) argument lies in its acknowledgement of the social nature of educational research. This nature may engender multiple variables but his fuzzy generalisations may encourage other researchers to replicate the research in order to take it a step further.

The issue of generalisability also impacts upon the question of the relevance of research to practice, since only if results are in some way generalisable will the research have practical relevance (Hammersley, 2002). The use of fuzzy language will help when the researched case *may* be exceptional but the researcher does not know this or is unsure. Bassey (2001) argues for the use of *findings* to denote what has been discovered from the case/people under study, while *predictions* extrapolates the findings to similar situations elsewhere. Hammersley's (2001) response to Bassey (2001) indeed recommends this as a mode of formulation rather than as a type of

generalisation. In my final chapter I have used my research findings to make recommendations rather than predictions.

The research methods: questionnaire, interview and diary

In this research study I have combined the quantitative method of the questionnaire with two traditionally qualitative methods, the semi-structured interview and the respondent diary. I chose a questionnaire and interview, and rejected observation for two reasons. First, as discussed earlier, I wanted to find out what people thought and had experienced, so it seemed more sensible to ask them through the medium of the questionnaire and interview than to observe them. Observation tells the researcher what people do, not what they think or what they have done in the past. Second, observation was not a practical option for me because I was carrying out my research part time in someone else's workplace as opposed to my own, and I could not spend the time at Upworld's premises that would have been necessary to carry out observations. Also, I suspect that the company would not have granted me such a high level of access.

The purposes of the research methods are different. The questionnaire provides basic data that can be subjected to simple numerical analysis and displayed in the form of tables and graphs (see chapter 4). The interview data provides insight into the opinions, experiences and values of 30 respondents. The diary provides a further picture of how one respondent carries out his unofficial role as a source of help and information for colleagues with computer problems. Also, within these methods there can be a mixture of approaches. For example, the questionnaire contained an open question, whose answers cannot be counted and displayed in a table, while from the interview and diary data I have, to a certain extent, enumerated some responses, although these crude counts are then, of course, amplified by the reasoning given. This illustrates Hammersley's (1992) distinction between more precise and less precise data and Wengraf's (2001) ideas of depth. There is little depth in the labelling and counting of

responses but the detail from the interview transcripts from which they were extracted provides that depth. I now want to look in more detail at the use of the research methods, concentrating on the interviews and the diary.

The questionnaire

The questionnaire is used in the first phase of the research to gather basic information, as in Bird's (1992) study referred to previously. One advantage of the questionnaire as a survey instrument, which supports its use in this research, is that it can be administered quickly to a large number of people. As such, it was designed to enable me to obtain an initial overview of the people in the survey: who they are, what they do and their view of some aspects of computer literacy. This view would then be utilised as a starting point for the discussions during the interview process. The design and piloting of the questionnaire is discussed in chapter 4.

Interviews: structure and ethics

The semi-structured interviews and the diary are used in the second phase of the research and build on the general picture presented by the questionnaire responses. The interviews are far more exploratory and carried out with 30 people selected from across various divisions of management and production. Details of the design of the interview schedule and the sampling strategy are given in chapter 5. The interviews were the principal method of data collection so I want now to look more closely at this method.

The positivist model of the interview is of a method of extracting data. In other paradigms, according to Silverman (2001), the model may be one of giving insights into experiences or generating meaning made together by the interviewer and interviewee. Silverman (2001) seems to miss something here, between the structured questionnaire and the open-ended interview. A broader and more useful mapping is provided by Arksey and Knight (1999), who suggest mapping different interview approaches to different levels of perception, using a framework of level and context. The level may be personal, sub-cultural or society-wide, and the context ranges from the unusual to the routine. At one extreme, personal perceptions of the unusual

involve an individual, distinctive understanding, requiring a qualitative interviewing approach. At the other extreme, society-wide perceptions of the routine involve shared understandings, requiring a more quantitative approach.

Much of the practical advice on research techniques presents interviews as an option. For example, there may be a clear statement that there is a relationship between the purpose of a study, the information needed and the research question, (Open University, 1991). If the study is exploratory, a questionnaire is appropriate; if explanatory, the use of interviews is recommended and if predictive, interviews and observations. This seems rather too clear-cut as, for example, interviews can be used to good effect in exploratory studies. This strand of the methodology literature often lists advantages and disadvantages of interviews *as opposed to* other methods. Typical arguments in favour of the interview are that it is a two-way interactive process, a conversation, more probing than a questionnaire, generating a lot of information, and giving an opportunity to clarify meaning (Open University, 1991; Bell, 1993; Cohen and Manion, 1994). It is adaptable and provides non-verbal as well as verbal information (Open University, 1991). Typical arguments against the use of interviews are that they are time consuming, that respondents are affected by their perceptions of the interviewer and that interviews are subjective, with a danger of researcher bias. Interview data are always collected in retrospect, at a distance from the events they describe (Burgess, 1984a; Scott, 1996). Also, since the researcher selects the interviewees and the data result from those selections, this brings the researcher's perspective to bear on the account (Scott, 1996). It seems to me that the arguments on both sides are no more than statements about the nature of interviews. It is true that interviews, for example, are time-consuming but this does not seem to be an adequate reason for rejecting the method in favour of, say, observation, which is surely equally time-consuming.

Two key ideas for typifying interviews are structure, and the extent of the interviewer's exertion of control (Drever, 1995). A highly structured

interview controlled by the interviewer is in effect an oral questionnaire, while a completely unstructured conversation is an ethnographic interview. This fits with Arksey and Knight's (1999) mapping, since an oral questionnaire would capture shared understandings of the routine, while an ethnographic interview would capture personal perceptions of the unusual. Semi-structured interviews come somewhere in the middle of the spectrum. Their key difference from the unstructured interview is that both interviewer and interviewee share a common frame of reference of the topics to be covered, enabling control and ensuring coverage. The semi-structured interview may flow from one topic to the next, with or without prompting or probing, to provide explanations and expansions.

Burgess (1984a) makes a link between interview structure and power by noting that:

> '...it is assumed that the interviewer can manipulate the situation and has control over a set list of questions that have been formulated *before* the interview and which are to be *answered* rather than considered, rephrased, re-ordered, discussed and analysed. In short, the interviewer is assumed to have power over the respondent, who is given subordinate role in this context...' (1984a:101)

In order to redress some of the imbalance of power, I tried to avoid the term *interview* in my correspondence and conversation with respondents by using statements like 'thank you for agreeing to talk to me', and I was careful to explain the purpose of the conversation and end it within the stated time. In conducting interviews the researcher is often advised to maintain a friendly tone, moving from general to specific questions, and avoiding giving personal opinions, remaining '...neutral but nice...' (Measor 1985:74). Scheurich (1997) critiques this type of advice from a postmodern perspective, on the grounds that there are inevitable asymmetries of power in an interview interaction, making it '...fundamentally indeterminate...' without any stable reality that can be represented (Scheurich, 1997:73). I would argue that this overstates the case but would agree that there is an imbalance of power in an interview in that the researcher controls it.

The Briggs-Wengraf model (Wengraf, 2001:43) of the interview situation attempts to illustrate how various components, including social role and history, contribute towards equilibrium in the balance of power. Interviewers are human, they have a history and a social role, and their manner may affect respondents by making them eager to please, encouraging them to give answers that they think are wanted or making them antagonistic. The power asymmetry may be conceptualised in terms of status or gender (Scheurich, 1997). My status during the interviews was that of someone doing research for my own purposes in the respondents' workplace, as their guest. In terms of how to present myself, it seemed that I had the option of appearing to be an academic or a fellow learner. The best option was to be myself, a researcher, but I was keen to avoid being seen as having a connection with management so I was frank about my reasons for wanting to talk to people. However, in terms of the Briggs-Wengraf model (Wengraf, 2001), I had a 'personal history' in that I am married to a senior manager at the factory, and was therefore known by name. Insofar as this affected the interviews, it probably helped more than hindered, certainly in terms of access. The impact of gender in terms of power relations is difficult to assess but it may mean that informants say different things (Silverman, 2001) or it may deny or privilege access. Traditionally, the ethical concerns in interviewing are for matters such as informed consent and the right to privacy. I told every interview respondent the purpose of my research and did overt tape recording, gaining their permission first. I also explained to them that although they were providing the raw data for my research, neither they nor the company would be named in the dissertation.

The discussion of ethics will be resumed later in this chapter and the practical aspects of conducting the interviews are dealt with in chapter 5.

The respondent diary

The use of the diary illustrates the non-linear, and perhaps serendipitous nature of research. I did not plan to use this research method at the outset of the study, but during the course of the interviews, several respondents mentioned colleagues as a source of knowledge and help in IT matters. One name that recurred was that of my husband, so I made the decision to ask him to keep a diary of any occasions when colleagues came to him with computer-related problems.

The use of an informant diary as a method of data collection is attractive because it can give detailed information about situations to which the researcher does not have access and cannot therefore observe (Burgess, 1984b; Open University, 1991). This is important for my research because I obviously did not have access to my respondents in their work situations. Such a diary would also provide insider accounts that include further data to complement that already collected (Burgess, 1984b). One potential problem in the use of an informant diary (Bell, 1993) is that the respondent might modify their behaviour to produce the account. This did not apply in my case, as my diarist was responding to events, not creating them; it was a reactive rather than a proactive diary.

A diary, by definition, is composed over time, and explicit instructions to the respondent are needed. My instructions to the respondent were to record the following details of occasions when he was asked for help with computer problems: who, when, what the nature of the problem was, what actions he took or helped the enquirer to take, and any comments he felt able to make on the request and the experience of dealing with it. I also asked him to let me know if at any time he felt that the keeping of the diary was too time-consuming. I later informally interviewed the respondent concerning his feelings about the episodes related in the diary and his role in relation to the people who asked him for help. The respondent's job at Upworld is that of environment manager, responsible for ensuring that the company operates within the legislative framework of the UK and the European Union for matters such as air emissions, waste, water discharges

and so on. In other words, he has no formal responsibilities for IT support at the factory, but he is one of a number of people whom others consult from time to time when they have problems with their computers. I felt that the diary might provide his perspective of the picture that people were presenting to me in the interviews. I was, however, aware of Nias's (1993) disappointment with the results when she used the method of respondent journals in her longitudinal study of teachers. She found the entries were:

> '...shorter, terser and less reflective that their writers were in face-to-face conversations and [she] found them much less informative than the interviews...' (1993:136)

She admits to expecting too much and she uses the entries to corroborate trends and patterns that she found in the interviews. Thus, for her, they were not a primary source of data. While I also found the diary entries of my respondent were short, I found them a useful source of data on informal learning from the perspective of someone whom other respondents consulted.

Ethical considerations and the site of the study

The ethical considerations involved in carrying out research can be viewed from two perspectives, the practical and the personal. The practical perspective is represented by various sets of guidelines such as those of BERA (British Educational Research Association, 1992), SERA (Scottish Educational Research Association, date unknown) and various universities, and by advice in the more practical research texts such as Bell (1993) and Blaxter *et al* (1996). The guidelines and advice typically cover matters such as gaining access to research sites, relationships with respondents, confidentiality and anonymity, and, in the case of contract researchers, relationships with sponsors and funding bodies. It is tempting to argue that these aspects are of greater concern to the ethnographer who, according to Ball (1993:32), has to carry out '...small deceptions...', cope with faux pas and the need to '...charm...' respondents into co-operation:

> '...Not only do researchers have to go into unknown territory, they must go *unarmed*, with no questionnaires,

> interview schedules and observation protocols to stand between them and the cold winds of the raw real...' (Ball, 1993:32 my italics)

This seems to imply that those who *do* use research instruments are in some way protected from the ethical dilemmas that occur. I would argue that Ball (1993) gives a false impression because these dilemmas are not the prerogative of the ethnographer. I was armed with a questionnaire and an interview schedule but these did not protect me from the 'raw real' ethical dilemma of being a researcher in my husband's workplace, with him as a respondent and with other respondents who, if they did not have a personal connection with *me*, had one with him. My research instruments could not diminish any uncertainties that I might have felt about this.

Bogdan and Biklen, (1982:50) refer to four ethical principles of research: protect the identity of subjects; treat subjects with respect and seek their co-operation; ensure clarity of terms when seeking permission to do a study; and tell the truth when you write up your findings. I am satisfied that I have followed the practical guidelines and advice with respect to the first three of these principles. I asked the respondents for permission before taping the interviews and promised them anonymity in the dissertation; I asked for and obtained permission from the plant manager to carry out my research and from the people who were to give up their time to help me in that research; and I have been clear about my purpose when seeking such permission. In addition, I have promised to give a copy of my dissertation to the HR manager. I have tried, hopefully with success, to abide by the general principle that the field should not be left more difficult for subsequent researchers (Johnson, 1984) and I am happy to devote the time if asked to co-operate in someone else's research, (Bell, 1993). The fourth principle referred to by Bogdan and Biklen, (1982) of telling the truth when writing up findings leads me to the personal perspective of ethics in research.

The personal perspective of ethics in research refers to me, in terms of the values that I hold both as a person and as a researcher. My research is carried out within the interpretivist paradigm because I want to try to reflect

what people say, but this will necessarily be filtered through me as the writer. In his recent examination of Foucault's approach to truth-telling, Peters (2003) refers to the multiple meanings that Foucault (1999) finds in the Greek word *parrhesia*, normally translated as *free speech*. These meanings include frankness, truth, danger, criticism and duty. I am trying to report what was said to me with frankness, but the analysis, which necessarily manipulates the words of the respondents, leads me to agree with Soltis's (1990:248) view that value-free research is a façade. My research cannot be value-free because it reflects *my* values in several ways: in the choice of topic, about which I have a viewpoint; in my reasons for doing research, in order to gain an Education Doctorate; in my analysis, where I choose which pieces of data to include for analysis and which to omit; and in my reporting of the research, where I am writing in the first person for much of the text. I do not claim that this study is objective; indeed it is debatable whether any research, including that undertaken within the positivist paradigm, can be completely objective, since all researchers and all subjects are themselves a product of cultural forces, (Peters, 2003).

Ethical considerations, in particular my stance in relation to the study, are also reflected in the choice of the site for the study. This is an illustration of the unpredictability of the research process. Access problems with respect to the site that I had originally envisaged in my research proposal caused me to refocus my research and, as a result, the site of research study is not the one that I had originally intended. I had proposed an exploration of varying constructions of 'computer literacy' amongst learners, tutors and employers linked by a particular project, aimed at the SME (small to medium enterprise) sector, in which the majority of learners who registered were engaged in IT-related learning. It seemed to be a particularly appropriate way of bounding the study, and I made a formal request to the project manager for access. Although initially this was dealt with promptly and favourably, access was subsequently denied to me on the grounds of confidentiality. I therefore proposed a refocusing of the research in two manufacturing and two service organisations. Unfortunately, access to three

of these organisations proved to be impossible to obtain, so the research had to be refocused for a second time and carried out within one organisation. I provided some background details of the site in the first chapter of the dissertation. The manufacturing company that forms the site for the research study, for which I propose to use the pseudonym Upworld, is known to me in that my husband is employed there as the environmental manager and I also carried out part of the empirical research for my MA there (Barnett, 1997). There are obvious ethical issues in this situation but this site was my only viable option.

I sought permission for access to the site from the plant manager, whom I did not know, and when selecting interviewees I opted, where possible, for people whom I did not know. Of the 30 interviewees, one was my husband and I knew a further two. As the next chapter will indicate, I received a very good response rate to my questionnaire, possibly because the covering letter sent with it mentioned that I had sought permission from the plant manager (appendix A3). I was aware that my prior knowledge of the company and its employees' knowledge of me might be both advantageous and disadvantageous. On the one hand, access to the employees was easier for me than for a stranger to the company, and it was possible that this would have an impact on the quality of the data obtained, making it richer. However, people might be less forthcoming in interviews if they perceive me as connected to the management in some way. In the matter of confidentiality, this was assured in the covering letter with the questionnaire. Also, in my research text I do not intend to identify any respondents by name

The access problems caused me delay and difficulty at the time, but they present a lesson for researchers. A research plan may be well thought out, with an appropriate background, methodology, research instruments and so on, but the process of research is always open to delay and change by unforeseen circumstances. The location of any research study has implications for the research process and the extent to which results can be applied. Locating the research in one setting will limit the extent to which I

can generalise my findings but may allow more in-depth exploration of some the issues. The research process is one of change, reflection, adaptation to change and development. I had to make a major adaptation before any data collection began, but this shift in the setting enabled me to reflect more on the nature of the research and on what I hope to achieve.

A further aspect of my diminishing choice of research site was that the site was male-dominated in the areas of production and distribution. Therefore I have chosen not to consider gender as a central issue in the research study. This is an issue that is already well researched from both educational and technological standpoints (Sacks and Bellisimo, 1994; Bradshaw *et al*, 1995) and the study would not greatly enhance existing knowledge in this area. Also, I am more interested in the perspectives of age and managerial status.

Summary

This chapter has presented the justification for the methodological choices that I, as a researcher, have made during the progress of the study. It has presented an overview of research methodologies and argued for an interpretivist approach that sees knowledge as subjective and socially constructed (Foley, 2000). The chapter has presented a summary of the qualitative/quantitative debate and argued for a combination of the two by referring to Bird's (1992) study. The chapter has justified the use of survey and case study approaches, using a questionnaire to collect basic information and provide a starting point for the design of the interview schedule, followed by semi-structured interviews and a respondent diary to provide depth and richness.

The use of a case study has an impact upon the generalisability of the study and the chapter has drawn on Bassey's (2001) concept of fuzzy prediction to support the nature of any generalisations that may be made. Finally in this chapter, I have clarified my ethical concerns related to my position as researcher, to practical concerns such as gaining access, the conduct of

interviews and informed consent, and to the choice of the site for the research.

The design and piloting of the questionnaire and interview schedule are covered in chapters four and five respectively. These chapters present an account of the process of the research in two phases, the results obtained and the analysis of those results.

Chapter 4 Research process: phase 1

Introduction

This chapter provides details of the first phase of the empirical research. The first subsection gives a brief account of the design, piloting and administration of the questionnaire. This is followed by a presentation of the questionnaire results and their analysis. A third subsection explains the link between this phase and the design of the interview schedule for the second phase of the empirical research.

The questionnaire contributes to the research study by asking people at Upworld to rate some suggested aspects of computer literacy. It provides a profile of the respondents, of their jobs and their use of computers. It gives an idea of the relative importance to them of common computer applications, of the Web, and so on, and provides a basis on which the interviews can build in the second stage of the research. My aim in this phase of the study was to obtain an overall picture of the employees at Upworld in terms of their age, gender and use of computers and to discover the extent of any consensus about what constitutes computer literary.

Design, piloting and administration of the questionnaire

One of the assumptions made in the use of a written questionnaire is that the respondents understand the questions in the way intended; if they do not, the data will not be valid, (Open University, 1991). Therefore, the start of the first phase of the study involved, after obtaining access to Upworld, the design and piloting of the questionnaire to test the validity and reliability of the questions. My first step was to arrange access to Upworld by writing formally to the plant manager to request permission to carry out my research. He gave his approval verbally and subsequently I contacted the human resources (HR) manager, who fulfilled the role of a key respondent

by providing me with basic information about, *inter alia*, the number, names and departments of the employees.

The next step was to design the questionnaire. In compiling the questionnaire I followed the advice to list, first of all, the information that I wanted (Open University, 1991). At this stage in the research I wanted to know who the respondents were and how they engaged with computers in their work, and I wanted some preliminary indication of what they thought about the idea of computer literacy. The questionnaire was then designed around these three broad requirements but in reverse order, so that the personal questions came last, as writers on research methods advise (Bell, 1993:82; Munn and Drever, 1990; Oppenheim, 1992:109). The pilot version of the questionnaire is given in appendix A1. It shows three basic questions with a final section asking for personal details. I now want to look at these items in more detail.

Question 1: table of statements

Question 1 presents a series of statements to be assessed using a Likert-type scale (Youngman, 1986). The design of the headings follows the recommendation of Sudman and Bradburn (1982:134) that it is essential to have clarity with regard to whether an attitude to be surveyed is affective (evaluative), cognitive (what the respondent thinks or knows) or action (willingness to do something). I have adopted headings that ask for evaluations that can then be measured using an intensity scale. The 18 statements were drawn mainly from various definitions of computer literacy found in the literature. I included aspects such as applications, programming, understanding of the workings of the computer and being able to go further than mere application literacy based on, for example, the work of Bostock and Seifert (1986) and McMillan (1996). I also included communication, the use of e-mail and the Internet, using ideas drawn from writers on the newer interpretations such as online literacy (Tuman, 1992; Carbo, 1997). The mix of tasks was suggested in part by Sullivan's (1993) research into the impact of computerisation on university-educated administrative workers. Some items, those concerning use of the mouse and

finding keys, were suggested by colleagues during my initial piloting of the questionnaire. To avoid *response set,* defined as:

> '...the tendency to answer all questions in a specific direction regardless of their content...' (Frankfort-Nachmias and Nachmias 1992:252)

the statements are presented in an apparently arbitrary order, ensuring that similar items are not together in a block.

Question 2: Is there anything else, missing from the above list, which you think indicates a computer literate person?

I included this question because I wanted to check that I had not missed an aspect of computers and computer literacy. The question is open, asking for additional ideas that can be followed up in the interviews.

Question 3: Which of the following computer applications do you use at work?

Question 3 is a grid type that asks the respondents to state the frequency with which they use common computer applications in their work.

Personal questions

The final page of the questionnaire presents personal questions. The age groups were designed to enable exploration of potentially varying views related to experience of computers. People now over 50 are likely to have worked when computers were largely non-existent in the workplace. Those aged 35 to 50 are unlikely to have had exposure to computers at school but will have witnessed their introduction into the workplace. Those under 35 are likely to have had a greater degree of exposure to computers at school, compared to the other two groups, and to have started their working lives when personal computers were a feature of the workplace.

Rough drafts of the questionnaire were shredded with friends and colleagues. *Shredding* is Drever's (1995) term for asking people to find faults, thus distinguishing it from *piloting*, asking potential interviewees whether the questions work. After a number of iterations the pilot version

was administered to three Upworld employees, drawn from across the workforce: a production worker, a process engineer and a senior manager. Many writers, for example Munn and Drever (1990), advise against piloting with anyone in the study itself; ideally, members of the target population, but not those in the sample, should be used. However, in this study everyone in the target population of the 169 employees would receive the questionnaire. It therefore seemed wise to pilot it with a very small number of that population, especially as the initial drafts were piloted with people outside the study. As a result of the piloting exercise I made minor amendments to the layout and wording of the first question and the final version of the questionnaire administered to the people at Upworld is given in appendix A2.

Various practical issues relating to distribution and collection need to be addressed when a questionnaire is used (Bell, 1993:85; Open University, 1991:51-2; Open University, 1996b:178-9). In this research study, the distribution of the questionnaire to Upworld's 169 employees was effectively carried out by post, using the company's internal mail system. To encourage response, a labelled return envelope was enclosed, together with a covering letter explaining the purpose of the research and thanking the respondents in advance for their assistance. A copy of the letter is given in appendix A3. Four questionnaires could not be delivered because the employees concerned were either on maternity leave or on long-term sickness absence, leaving a population surveyed of 165. I received 115 replies, a response rate of 70.3%.

Results and analysis

This subsection follows the stages in the analysis of questionnaire data given by Munn and Drever (1990): preparation, description and interpretation.

Data preparation

In the preparation stage most of the data from the questionnaires was transferred into a Microsoft Excel spreadsheet with the replies from each respondent occupying separate rows. An extract from the spreadsheet is shown in appendix A4. The column headings are the question numbers. Each item in question 1 was numbered from 1.1 to 1.18, and in question 3 from 3.1 to 3.7. Responses to question 2 were not entered into the spreadsheet. The responses to question 1 were given scores where 4 = essential, 3 = very important, 2 = useful, 1 = not important and 0 = can't decide. The spreadsheet columns could then be totalled to provide an overall ranking for the 18 items. Also, the spread of rankings for each item could be compared. If any respondent omitted an answer in question 1, a 0 was recorded, although there were very few occasions where this happened. I avoided totalling each individual respondent's scores or calculating an average rating for each task, because to do so would be to assume that the scale was an evenly-spaced interval scale. I was counting rather than measuring responses using a Likert-type scale, which is not an interval scale; no conclusions can be drawn about the meaning of distances between scale positions.

Responses to question 3 were entered as D = daily, W = weekly, L = less than weekly, N = never. The columns of the spreadsheet would then show the frequency with which the respondents use the various aspects of the computer. The remaining questions were coded as follows: the age groups were Y = under 35, M = 35 - 50 and O = over 50; the job and the qualifications were entered as text.

Data description and interpretation

Following Munn and Drever (1990), data description and interpretation was then a matter of carrying out a number of extractions from the spreadsheet and considering the results.

Although it was at the end of the questionnaire, I began with the personal data. I extracted a profile of the respondents in terms of age, gender and managerial status. This is shown in table 4.1 below.

	Non-managers	Managers	Total
Male	74	25	99 (86%)
Female	12	4	16 (14%)
Total	86 (75%)	29 (25%)	115 (100%)
Over 50	33	7	40 (35%)
35-50	44	16	60 (52%)
under 35	9	6	15 (13%)
Total	86	29	115

Table 4.1: Overall profile of employees

The table shows that 86% of the respondents are male, and 87% are over 35. Although gender and age are not a primary focus of the research, they may have an impact upon the respondents' constructions of computer literacy.

I then grouped the respondents into seven categories, four of which were production line operatives, maintenance fitters, warehousemen and office administrators. Initially, I conceptualised these four groups as *non-managerial*, by which I mean that the people in these four groups have little or no responsibility for people or resources across the plant-wide operation. The three remaining occupational groups were production supervisors and technicians, senior production managers and senior non-production managers. Initially, I conceptualised these groups as *managerial*, by which I mean that the people in these groups do have responsibility for people and resources across the general operation of the plant. This initial grouping carried the possibility of looking at differences in managerial and non-managerial perspectives of computer literacy and computer learning, if

indeed such differences were apparent. Inevitably, I have made conceptual choices in this initial categorisation; the division into managerial and non-managerial groups makes implicit references to economic and social factors that characterise the groups. The age and gender profiles of the seven groups are shown tables 4.2 and 4.3 below.

Group		Number	Male	Female	Over 50	35-50	Under 35
A	Production line operatives	58	58	0	24	33	1
B	Maintenance fitters	10	10	0	6	3	1
C	Warehousemen	5	5	0	1	1	3
D	Non-production administrators	13	1	12	2	7	4
	Total	86	74	12	33	44	9

Table 4.2: Profile of non-managers

Upworld has no female employees in shop-floor positions and thus there are no female respondents in groups A to C. The majority of those in the non-managerial groups are over the age of 35.

Group		Number	Male	Female	Over 50	35-50	Under 35
E	Production supervisors and technicians	9	9	0	2	6	1
F	Production managers, engineers and chemists	12	11	1	2	7	3
G	Non-production senior managers	8	5	3	3	3	2
	Total	29	25	4	7	16	6

Table 4.3: Profile of managers

Again, the profile is one of a workforce that is predominantly male and over the age of 35.

Twenty-five respondents answered the question concerning qualifications in aspects of IT, and of these, 10 referred to training courses, an interesting indication that some respondents equate training with qualification; this was followed up in the interviews. Of the remainder, eight had qualifications that they described as basic or RSA (Royal Society of Arts) and seven had either a degree or professional qualification that included some IT element. Thus, out of 115 replies only 15 (13%) had any kind of IT qualification. The summaries of personal data provided the basis for further analysis when viewed in conjunction with the remaining data.

After extracting the personal data, I moved on to the three questions. The responses to question 1 were scored and totalled as described earlier and the results are shown in table 4.4.

Question number	Item descriptor	Score
1.1	Use a mouse	406
1.4	Find standard keys	383
1.6	Enter data into database	338
1.5	Enter data into spreadsheet	335
1.2	Use word processor: letter	333
1.12	Write and send emails	323
1.3	Manage files	322
1.13	Connect up a PC	309
1.10	Identify cause of problems	292
1.15	Attach a file to an email	286
1.8	Apply designs: word-processing	271
1.7	Install software	264
1.14	Obtain information from WWW	247
1.11	Design: spreadsheet	222
1.16	Explain parts of a PC	221
1.9	Design: database	215
1.17	Design: web page	171
1.18	Write code	169

Table 4.4: Overall ranking of computer literacy attributes

The table shows the overall rankings of each aspect of computer literacy, given by totalling the rankings from each respondent. The minimum

possible score is zero, in the unlikely event that no-one could decide upon a response to anything, and the maximum is 4 × 115 = 460. The top six items in this raw allocation are basic tasks of manipulation such as using a mouse and finding standard keys, coping with data entry into or basic use of the common applications of the database, spreadsheet and word processor; and communication (writing and sending emails). By contrast, the bottom six items include design, programming, explanation of functions and obtaining information from the web. I also compiled a second version of table 4.4, showing the frequency of the allocation of the rankings to each item. This is shown in appendix A5. This table is ordered in the first instance by the rankings for *essential* then by those for *important*, and so on, so the order differs slightly from that of table 4.4. The ranking still affords greater weight to simpler, operator tasks than to those involving design or knowledge manipulation. The second version also illustrates areas of agreement and disagreement that are interesting. For example, there appears to be general agreement that using a mouse and finding standard keys are either essential or very important, but for items such as identifying the causes of problems or installing software there is a spread of rankings. I used table 4.4 in the second phase of the empirical research.

There were 10 responses to question 2, asking for any additional factors of computer literacy, and these are listed in appendix A6. Munn and Drever (1990) advise that in a questionnaire, open questions may be analysed using one of two approaches: using a framework devised in advance or deriving one from the data. I wanted to do the latter in order to inform the interview schedules, possibly deriving further potential aspects of computer literacy. Three of the replies suggest tasks that are at the operator level: keyboarding skills and switching on or off. Three respondents mentioned personal control: getting *what you need* for the job, getting things printed *the way that you want* and using new software to do *what you want* in a basic form. One mentioned the control panel, one moving between applications, and two talked of being *comfortable* with the computer, not being *frightened* of it. There were interesting points in these few comments for the interview

schedule, suggesting further enquiry into the computer as a tool in the service of the user and into personal feelings such as discomfort and fear.

In order to describe and interpret the data from question 3 concerning computer usage, I extracted three bar graphs from the spreadsheet. The first is shown in figure 4.1 below:

Fig. 4.1: Graph of overall computer usage

Fig.4.1 shows a bar graph of the usage over the whole set of respondents. Daily use of databases, email and spreadsheets is predominant with least daily use of either desktop publishing/presentation packages and the Internet.

Figures 4.2 and 4.3 show this data split between non-managers and managers.

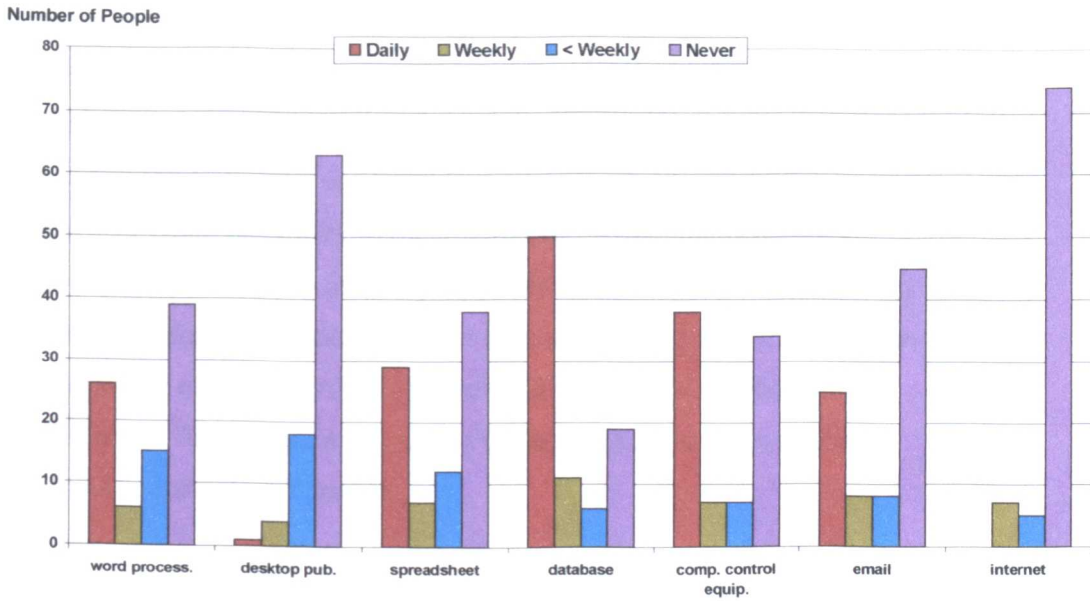

Fig.4.2 Computer usage: non-managers

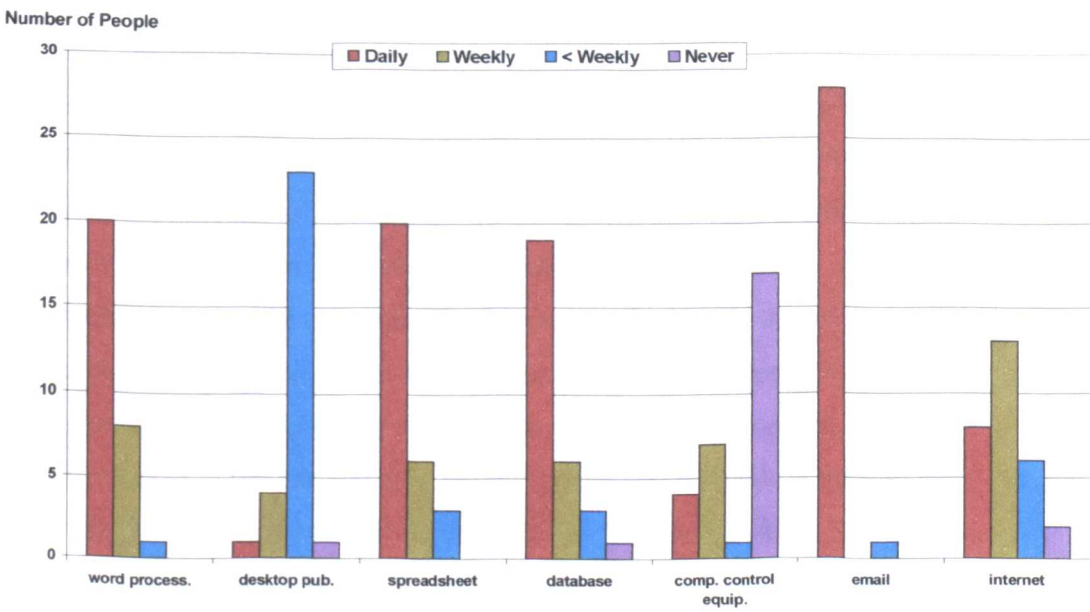

Fig.4.3 Computer usage: managers

Here there is a contrast, in that the usage profiles of everything apart from databases are different. For example, managers are far heavier users of email and the Internet than non-managers. These differences in usage support the idea of exploring differences in perceptions of computer literacy and also learning. The use of computers, as illustrated by figures 4.2

and 4.3, differs between the managers and non-managers, so it might be expected that some respondents will give greater weight to simple operator tasks as an indicator of computer literacy because that is all that they do with the computer in the workplace. For example, the maintenance fitters require the ability to look at information on a screen, the production operatives require the ability to input numerical results into a database, while supervisors must be able to produce short reports on activity during the shifts. On the other hand, managers who use the Internet or manipulate large amounts of data to produce reports might naturally ascribe greater importance to file manipulation, use of the Internet, or perhaps database design as an indicator of literacy.

It was tempting to go further in the interpretation of the questionnaire results and look for patterns such as the profile of the computer literate person given by different occupational groups, or by the different age groups. This type of analysis, however, did not fit with my approach to the research generally and would not provide evidence of any causal relationship between for example, age and construction of computer literacy, nor would it establish any explanation of computer literacy since respondents' views in any piece of research are views and not explanations (Silverman, 1993; Drever, 1995). The main purpose of my analysis was to provide a descriptive profile of the construction of computer literacy by the employees generally, and to stimulate ideas and suggestions for the interview schedule. The questionnaire provided part of the answer to two of the research questions posed in the introduction, those relating to what constructions of computer literacy are found in this company and the usage made of computers, and it also provided the basis for further exploration of these and other questions.

Link to the interview design

The analysis of the questionnaire data told me who people were, what they did and gave me a profile of their computer usage, as well as providing the basis for the second phase exploration of the research questions posed in the introduction. In the second phase, I intended to build on ideas generated by the literature search and the questionnaire analysis to compile a schedule of topics for the interviews. At this stage, the interview schedule was no more than a set of ideas for questions and these are now indicated using the questionnaire headings.

Question 1: table of computing tasks/knowledge

This provided an overview of the constructions of computer literacy amongst the employees of Upworld, which begins to answer the second research question. Further interpretation is a matter of looking for patterns. A theme running through the literature review was that of categories and levels, for example, occupational categories (Reich, 1992); McMillan's (1996) extension of Papert's (1993) concept of letteracy; and Conlon's (2000) fable of the technician, craftsman and visionary. In the interviews I wanted to explore the respondents' perceptions of computer literacy. I wanted to know whether, for example, they thought that there were levels of computer literacy, whether they felt that computer literacy was a function of someone's job, and whether they perceived that there was computer *il*literacy.

Question 2: Is there anything else, missing from the above list, which you think indicates a computer literate person?

Although there were few responses to question 2, they provided potential ideas that I wanted to follow up in the interviews in order to contribute to an answer to the second and fourth research questions. These ideas include: the extent to which people perceive the computer as a tool that *they* control; how they feel about computers: whether they experience feelings of discomfort or fear and why; and the extent to which they can move easily

between applications, for example, between those they use at work and at home.

Question 3: Which of the following computer applications do you use at work?

This provided an overview of the usage of computers at Upworld and thus will help in answering the first research question. The overview is also the basis for interview questions concerning how people learn their computer skills and whether they use their skills solely for work or also at home.

Personal questions

Only 15 of the respondents (13%) had any kind of IT qualification, so there were potential questions here concerning learning. In the interviews, I wanted to explore how the computer skills and knowledge had been acquired by the respondents, whether people develop their computer skills and knowledge outside work, how people perceive their own skill needs and what value is placed on qualifications in either IT or computer literacy.

Summary

This chapter has presented an account of the first phase of the empirical study, including the design, piloting and administration of the questionnaire, the questionnaire results and their analysis, and the link to the design of the interview schedule.

In the previous chapter I referred to Bird's (1992) use of a combination of a questionnaire in the first phase of her study, followed in the second phase with in-depth interviews. My first phase, like that of Bird (1992), has a different rationale from the second, in that the questionnaire has provided a number of avenues to be explored through the use of interviews and the respondent diary in the second phase. First, the overview of Upworld's employees' construction of a computer literate person has provided a starting point for a discussion during the interviews. The list of rankings in table 4.4 is the basis for part of the interview schedule (see chapter 5). Second, the answers to the question about what the respondents use

computers for in their work and with what frequency, provide the basis of an answer to the first research question and also confirm the idea of exploring any differences between this and their use at home. This is continued in questions in the interview schedule. Third, the personal details provided by the questionnaires not only form the basis for my initial, albeit crude, categorisation of the workforce into the seven groups, but also aid the sampling of respondents for the interviews.

The second phase of the study, described in chapter five will involve the development of the interview schedule to be used in a series of semi-structured interviews with a sample of the questionnaire respondents, and the use of a respondent diary. The data from these interviews and the diary expand on and add depth to the questionnaire data, thus enabling further exploration of the issues raised by the research questions.

Chapter 5 Research process: phase 2

Introduction

The questionnaire results gave an overall picture of the employees at Upworld, of their use of computers in their work and of their view of what factors contribute to the concept of a computer literate person. Further development was needed to continue the exploration of the first two research questions on changes at work and perceptions of computer literacy, and to collect data in order to answer the third research question on learning and the fourth on the boundaries between work and home. The second phase in the gathering of this data was the round of semi-structured interviews with a selection of the respondents, together with the respondent diary. This chapter presents an account of the second phase of the study, with subsections covering its relationship to the research questions; the design and piloting of the interview schedule; the sampling strategy and conduct of the interviews; reflections on the analysis process; and the substantive analysis of the data from the interviews and the diary. The discussion of the analysis is presented in chapter six.

Relationship of the research questions to the research phases

It seems helpful to summarise at this point. The research questions have generated ideas for the questionnaire and interview schedule as shown in table 5.1:

Research question	Questionnaire/Interview schedule
1. How has computer technology affected individuals in the workplace in terms of work itself and the way they work?	Question 3 of questionnaire provides overview of usage in the plant. Interviews will provide data on change and skills needed to use computers.
2. What do individuals think computer literacy means for them and how do they feel about the computer?	Questions 1 and 2 of the questionnaire provide the starting point for this. Developed in the interviews.
3. How do individuals learn how to use a computer?	Interviews and diary will provide data on this.
4. Is this learning transferred between home and work or are there boundaries?	Interviews will provide data on this.

Table 5.1 Mapping of research questions to research instruments.

This mapping is developed in this chapter and the eventual detailed mapping is provided on page 92 in fig.5.1.

Design and piloting of the interview schedule

In the design of the interview schedule I followed the advice of Drever (1995) and constructed a preliminary draft schedule made up of main questions with probes and prompts. Prompts are designed to stimulate an answer, whereas probes are intended to go deeper. My questions were drawn from both the literature and the questionnaire results concerning usage, and were designed to explore aspects of each of the research questions. These questions covered the use of the computer in more detail, essential skills, learning and computer literacy. The first version of the schedule is shown in appendix B1.

Just as Munn and Drever (1990) advise the shredding and piloting of a questionnaire, Gillham (2000) advises the trialling and piloting of an interview schedule. As with the questionnaire, I carried out an iterative process of trialling that involved testing out my questions with colleagues, incorporating their comments at each stage then, after feedback from my supervisor, piloting the schedule with the first respondent. The final version used throughout the interview stage is shown in appendix B2. I also developed a separate record sheet to record details of each respondent's

name, job title and age group, to attach to each interview transcript. A copy of this is shown in appendix B3. I adopted the suggestion, made by a friend with whom I tested a version of the schedule, that I show to the respondents the results of the questionnaire and ask what they think, thus using the results to prompt a discussion. The final version of the interview schedule also includes the introductory and closure questions and the suggested probes and prompts.

The interview schedule has five basic sections. The introductory section is essentially a memo to myself, so that I did not forget important points such as confidentiality when I began the interviews. The second section on the impact of computers at work (questions 1.1 to 1.3) is informed mainly by the first research question (see mapping on page 92), although it leads into the questions about learning. The third section on learning has separate questions for initial computer learning, which may have been many years ago, and for computer learning more recently. I intended that the probes here would provide data about the levels of informal learning at Upworld. Questions 2.1 to 2.3 on computer learning reflect one of the two key themes of the research study. The questions on home use and attitude to computers lead to the other key theme of computer literacy. The fourth section of the interview schedule (question 3) is not really a question but an introduction to the discussion using the list of rankings from the questionnaire data. This list is shown in table 4.4 on page 81. The questions in the last section are intended to wind the interview down, and I did occasionally find that the respondents added to what had already been said. I also felt that it was important, after the interview had finished, to record my own reflections in my field notes to help in the subsequent analysis.

The detailed mapping of the research questions to the interview questions is shown in figure 5.1:

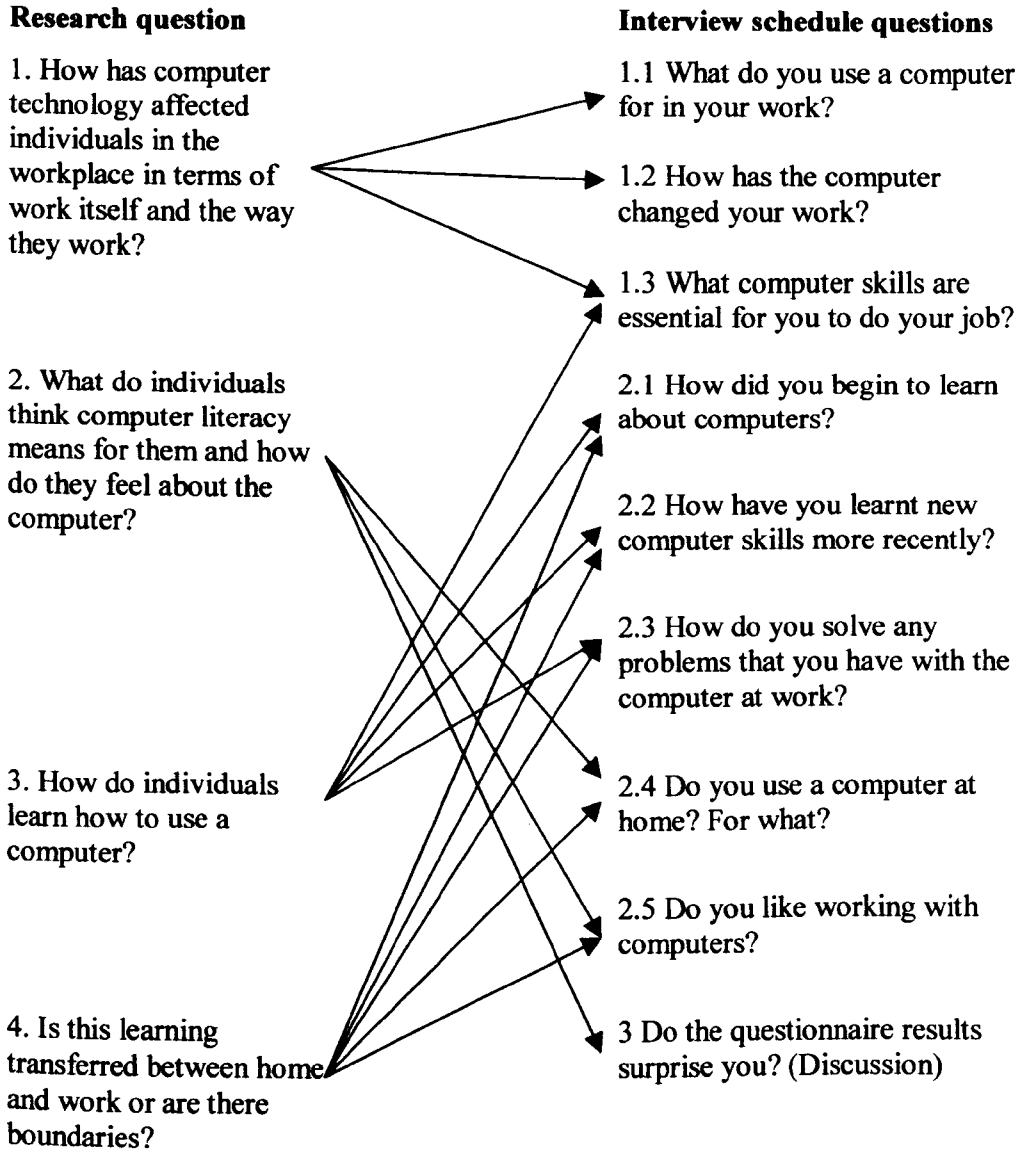

Fig 5.1 Detailed mapping of research questions to interview questions.

Sampling strategy

In any research study the sampling method, like the methodological approach, reflects the researcher's view of the social world, since it is assumed that the population will behave in the same or in a similar way to the sample. Some form of sampling for the interview stage was necessary, as it was impossible for me to talk to everyone at Upworld. Sampling can be classified as either probability sampling or non-probability sampling. The

former is more appropriate for quantitative studies where the extent and composition of the whole population is known, so that a representative sample can be taken. Non-probability sampling methods used in a qualitative approach are many and varied (Miles and Huberman, 1994:28); the most appropriate for my purpose seemed to be a form of stratified purposeful sampling, where suitable subjects are chosen from identified sub-groups of the population. I wanted a sample that provided a picture of Upworld in microcosm, a selection of individuals who represented the variety of work functions carried out at Upworld.

I selected individuals to represent the mix of age, gender, occupations and grades in the company, as far as possible. My initial groupings at the questionnaire stage were between managers and non-managers, as described in the previous chapter. This resulted in a stratification of seven sub-groups from which I chose the participants. I grouped the returned questionnaires according to these sub-groups, then selected respondents to represent as far as possible the age and gender mix in the company. This did not result in an even mix of either age or gender because, for example, four of these subgroups are all male and another is all male bar one. However, my concern in this research study was more for comparison of the opinions and experiences of managers and the managed, of people in different occupations using computers for different purposes, rather than comparison of the gendered experiences of men and women. A list of the 30 respondents chosen, showing their occupational, gender and age groupings is provided in appendix B4. The list is ordered according to the chronology of the interviews. When using quotations from the interview transcripts in this and the next chapter, I have identified the speaker by their chronological number: Int1, Int2 and so on.

Conduct of the interviews

The interviews were carried out over a period of five months from mid-November 2001 to mid-April 2002. In addition to taping and transcribing the interviews, as described below, I kept a field diary recording my impressions of each interview and this helps to inform the discussion of the results.

A practical aspect of interviews is the method of recording the conversation. The choice between taping and note-taking has implications for both parties (Blaxter *et al*, 1996). The taping of interviews allows the researcher to concentrate on the process, focusing attention on the respondent and on the non-verbal aspects of the interview, such as body language and silences, but may make the respondent anxious or self-conscious. Note-taking provides the researcher with an instant record of the conversation, without the worry of tape recorders or batteries failing (I experienced one example of each!) but may be distracting for the respondent. For these reasons, I decided in favour of taping. Although the transcription proved to be time-consuming, it allowed me time for reflection and for some preliminary analysis. To relieve the boredom of typing, I adopted the practice of printing off each page on completion, then pausing to underline points or make marginal notes.

The process of analysis

Analysis as an activity

I want to begin my reflections on the analysis process by emphasising two points. The first is that analysis of qualitative data is not a single activity; it is often defined in terms of multiple processes. For example, it is said to involve the description and classification of phenomena and looking for interconnections between concepts (Dey, 1993); data reduction, display, conclusion drawing and verification (Miles and Huberman, 1994); data preparation, analysis and the summary of results (Drever, 1995); and data preparation, description and interpretation (Munn and Drever, 1990). Mason (1994) also makes a theoretical distinction between indexing and retrieval

activities designed to make data more manageable, and creative work on the product of these activities to develop the analysis. However, this theoretical distinction becomes blurred because, Mason (1994) argues, creativity is required in the indexing decisions as well as in the analysis.

The second point to emphasise is that analysis is not a distinct stage of research. It does not take place in isolation, after data collection and before interpretation (Bryman and Burgess, 1994; Silverman, 2000; Hammersley and Atkinson, 1983). Indeed, to present analysis as a separate stage after data collection and before discussion, could be said to illustrate a lack of reflexivity in a study, (Hammersley and Atkinson, 1983). Lofland and Lofland (1984:132) represent this point well in a diagram showing analysis and collection running in parallel through time until data collection ceases:

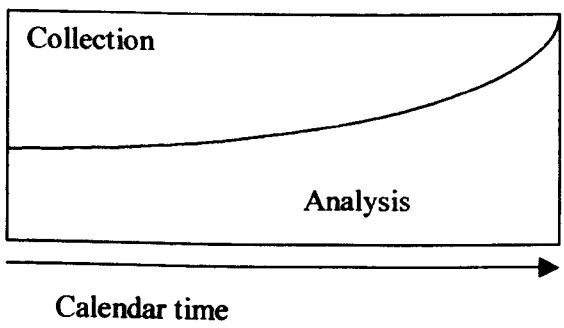

Fig 5.2 Analysis through time, adapted from Lofland and Lofland (1984:132)

Silverman (2000:119) is particularly critical of research designs that devote a set period to data gathering, followed by analysis. He advises starting analysis as soon as possible, by analysing data as it is gathered.

Huberman and Miles (1998) make the point that:

> '...the *design* of qualitative studies can in a real sense be seen as analytic...' (1998:184 my italics)

There are elements of anticipatory analysis in the design of this study, in aspects of the questionnaire, in the formulation of questions, prompts and probes for the interview schedule and in the decisions made concerning which sections of data to code and which to ignore. Thus the design of my interview schedule involved an anticipatory reduction of the data by

focusing on the use and effect of computers (questions 1.1, 1.2, 2.4), the skills needed to use them (1.3), learning (2.1-2.3), attitudes (2.5) and computer literacy (3). Also, as described in the previous subsection, I did carry out some elementary analysis as I gathered interview data and transcribed the tapes, making marginal comments and occasionally cross-referencing to previous transcripts. It is true that:

> '...The tape will always wait patiently to be transcribed; the ideas that spring from you as you write will vanish quickly...' (Wengraf, 2001:210)

In preparation for the substantive analysis, I numbered the respondents and the interview transcripts chronologically, by order of the interviews. Each transcript was paginated, thus providing an address for subsequent extracts or quotations. For example, 10:8 would refer to an extract from page 8 of transcript number 10.

Substantive analysis

The substantive process of analysis began when all 30 transcripts were finished. The essence of qualitative analysis is in the related processes of describing phenomena, classifying it and looking at how the resulting themes interconnect (Dey, 1993). The discovery of different classes of items, persons or events and the properties that characterise them, is probably the most familiar analytical technique because it is well known from grounded theory (Strauss and Corbin, 1998) and is a fundamental operation regardless of whether the grounded theory approach is used. A number of descriptive categories were emerging from my data, even at an early stage. In a sense, some were anticipated through my use of a semi-structured interview, where the anticipated responses formed my prompts. For example, when asking people what they used a computer for at work, I anticipated that they might talk about producing documents, inputting information or sending e-mails, so these became my prompts. A summary of my anticipated categories is given in the table in appendix B5 and some of these anticipated categories did indeed emerge. However, not all responses can be assigned to categories in this way (Dey, 1993).

In the methodology literature, the coding process may be described using terms such as *labelling, categorising* or *indexing*. I followed Miles and Huberman (1994) and used the term *code*, defined by them as:

> '...tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study...' (1994:56).

This is coding for theory generation rather than coding for text retrieval (Bryman and Burgess, 1994) and it is part of data reduction, that is, the process of deciding which sections of data to code and which patterns best summarise a number of sections. I adopted a macro approach, applying codes to speeches or parts of speeches rather than to individual words or phrases. Coding is a matter of looking for conditions, interactions, strategies and consequences. Bryman and Burgess (1994:7-8) cite three examples of code classification. The first are generic codes (Bogdan and Biklen, 1982) that include, for example, setting/context, process, activity, strategy or personal relationship codes. The second are descriptive, interpretive, explanatory and astringent (summary) codes (Miles and Huberman, 1984). Thirdly, Bryman and Burgess (1994) refer to Lofland's (1971) social phenomena classification of acts, activities, meanings, participation, relationships and settings. Patterns of themes, causes or explanations, relationships and theory can then emerge from the codes. The codes at this stage tended to be descriptive of the content (Miles and Huberman, 1984) rather than interpretive or conceptual, what Strauss and Corbin (1990) call open coding.

In developing my codes, I initially tried an alphanumeric system, but reverted to more descriptive labels, as I found the former confusing. I developed 51 descriptive categories listed in the coding dictionary shown in appendix B6. In coding the responses to question 1.1, for example, I found that the data could be described using six codes, as shown in table 5.2:

Code	Meaning	Example from transcript (respondent)
Comms1	Using e-mail	'*...I've got e-mail, my own e-mail address which is cc-mail for the company...*' (Int30)
Package	Referring to a specific application, such as Word or Access	'*...I use the database, Access database, to track production...*' (Int21)
Info	Searching for, passing on or analysing information	'*...We also use the computer for scrap figures and downtime figures...*' (Int6)
Enter	Entering data	'*...I'm entering stuff into the database when the job's running...*' (Int29)
Control1	Controlling, for example, machinery or documents	'*...Document control to keep track of conversations...*' (Int28)
Produce	Creating something, for example, reports	'*...We use it for producing check sheets and graphs...*' (Int15)

Table 5.2 Example of codes

At this point I wanted to experiment with forms of display for the data. Data display is defined as:

> '...an organized, compressed assembly of information that permits conclusion drawing and/or action taking...'
> (Huberman and Miles, 1998:180).

I created a matrix, using a Microsoft Excel spreadsheet, with 30 rows, one for each respondent, and 14 columns. The first five columns gave the number, initials, gender, age group and work group of the respondent and the next nine gave an indication of their responses to the questions. The entries in these cells took the form of a brief verbatim extract from the transcript. An extract from the matrix is given in appendix B7. This created a very large matrix, so I then copied the first five columns plus the individual question columns into a series of nine further matrices to give me one for each question; again, an extract is shown in appendix B7. Each of these could then be manipulated by using the 'sort' facility in Microsoft Excel to group the responses by gender, age group or work group. I also created a further set of Microsoft Word files, this time containing the

descriptive codes that I had developed, by copying and pasting from the question files. This enabled me to collect together all relevant sections relating to a code, regardless of where they came in the interview transcript. An example is shown in appendix B7. This is the horizontal slicing of data referred to by Mason (1994:95). It carries the limitation that the extracts are now out of their context, but I copied them with the address referred to earlier of transcript number and page number, so that I could refer back to the context when the need arose. I could now use these files with the spreadsheet summaries to analyse the data.

I now wanted to look for more conceptual themes in the data and relate these to my research questions. One essential purpose of coding is to discover the range of perspectives in the data, for example, the range of the respondents' experiences of learning, some of which were anticipated by me, while others emerged from the data. It seemed logical to begin by using an elementary quantitative approach and count instances of experiences and perspectives, where appropriate. I found Mason (1994:96-8) useful here. She used elementary counting at the start of her analysis and makes some important points. First, the amount of data relating to different experiences may not be comparable between respondents. One person may talk at length about their training, for example, while another simply acknowledges it. Second, although I can count how many instances there are of, say, observing others or of reading manuals, I cannot be certain that those who do *not* mention these experiences have not had them. Mason's (1994) argument is that this is only a problem if the intention is to create variables for statistical analysis. This was not her intention nor was it mine. I needed an idea of, say, the range of learning experiences or of computer usage, and so on. In using Mason's (1994) approach, I was beginning somewhere near the middle of Huberman and Miles' (1998) set of tactics for generating meaning, since counting is placed by them at number five on a spectrum from one to 13, ranging from the descriptive/concrete to the explanatory/abstract. Another useful classification is that of thinking units, (Lofland and Lofland, 1984). These are presented on a scale from microscopic to macroscopic, that is, from meanings and practices to social

worlds and lifestyles. I was certainly looking for meanings, practices, episodes and encounters but I also found the thinking unit of roles useful, as I discovered these in the interview data when respondents spoke of the people whom they consulted about their computer problems.

The next subsection presents the analysis of the interview data from the responses to each question, including, where appropriate, analysis of data from the general discussion.

Analysis of the interview data

The first research question is 'How has computer technology affected individuals in the workplace in terms of work itself and the way they work?' This is informed by the first three questions in the interview schedule concerning computer use, the effect of change and the computer skills needed for work These questions do not readily admit of a single answer, so I approached the analysis on two levels by looking first at the initial responses, then carrying out a deeper analysis to develop and saturate the categories in the coding dictionary.

Question 1.1 What do you use a computer for in your work?

Details of the initial reactions to the first question are summarised in table 5.3 below:

Response	A-D	E-G	Total
'Everything'/ 'several things'	5	7	12
A general activity such as communication	3	5	8
A specific activity such as reports or data collection	2	3	5
A specific package such as Access or 'the database'	4	1	5
Total	14	16	30

Table 5.3 Initial reactions to question 1.1

The reaction of 20 respondents, 12 managers and eight non-managers, was phrased generally, either as a response such as '*...everything...*' or '*...several things...*' or as the mention of a general activity such as communication. By contrast, the remaining 10 respondents, four managers and six non-managers, mentioned a specific activity such a data collection or a specific application. The two non-managers who talked of specific activities were the only respondents to react to the question by stating their actual job: '*...keeping control of stock...*' and '*...production planning...*'.

For further analysis of this question I used the six categories as shown in the coding dictionary (appendix B6) and a summary table is shown in table 5.4:

Code	Meaning	A-D	E-G	Total
Info	Searching for, passing on or analysing information	9	13	22
Comms1	Using e-mail	6	15	21
Package	A specific application such as MSWord	8	8	16
Produce	Creating documents or loads	4	8	12
Enter	Entering data of some kind	8	1	9
Control1	Controlling machinery, documents, aspects of the plant.	2	4	6

Table 5.4 Responses to question 1.1

The analysis confirmed the different levels of usage in the groups shown by the questionnaire analysis in chapter 4. The production operators (group A) enter data in a database to pass on information, use e-mail and may use Word to write reports. Maintenance fitters (group B) take information from a database and use e-mail. There is low usage in the warehouse, group C, and both respondents from that group described their usage in terms of the job rather than referring to specific packages:

> '*...keeping control of the stock...it dictates to us how we pick a load...*' (Int13)
>
> '*...initially it's the dispatch, loading, things like that...*' (int24)

Occasionally, the warehousemen also need to enter data and print stock lists.

Usage in the remaining groups is more varied. The administrators in the sales, personnel and accounting functions (group D) use e-mail, various databases, spreadsheets and Microsoft Word. Usage by the production supervisors and technicians (group E) is also varied, and includes CAD packages. Both group F, production managers and G, managers in functional areas such as sales, accounting, environment and logistics, also analyse information and are heavier users of the Internet. This is unsurprising, as the workplace usage is determined by the jobs that people do. The picture may be different for home usage, analysed in a later subsection.

Question 1.2 How has the computer changed your work?

The initial reactions to this question are summarised in table 5.5 below:

Response	A-D	E-G	Total
General comment such as 'made it easier'	7	6	13
Specific change, such as 'better communication'	5	5	10
Specific effect on respondent	1	4	5
Can't say: always known them	1	1	2
Total	14	16	30

Table 5.5 Initial reactions to question 1.2

There were general comments or mention of a specific change from 28 respondents, but two could not respond to the question, as they were young enough to have grown up with computers during their schooldays and work experience. Table 5.5 indicates little difference between the managerial and non-managerial groups, except for the slight indication that managers perceived a specific effect upon themselves.

The further analysis of the data from this question, using the categories in the coding dictionary is summarised below in table 5.6.

Code	Meaning	A-D	E-G	Total
Comms2	Effect of e-mail on communication	12	16	28
Control2	Control over work, documents, machines etc.	11	14	25
Paper	Increase/decrease in paperwork	10	11	21
Judgement	Effect on using/suspending personal judgement	6	11	17
General	Work is easier/harder	4	11	15
Time	Saving/consuming time	6	5	11
System	Effect on a system, on procedures	7	3	10
Noeff	No change	1	1	2

Table 5.6 Responses to question 1.2

The analysis revealed a variety of changes, often linked to the jobs done by the respondents. For all groups, the changes to communication were among the most important, but there were differences of opinion. For example, there was much comment concerning the effect of e-mail on communication, sometimes on the method (e-mail as opposed to letters or face-to-face) and sometimes on the interaction (whether it enables or disables interaction with others). E-mail was regarded as quick because it reduced the irrelevancies in speech, it provided proof of actions carried out and it enabled dealings with others. However, its use could also lead to the wrong assumption that the receiver of a message would indeed act upon it. E-mail was also said to provide less opportunity for rapport. The following extracts illustrate the debate:

> '*...you can work more remotely from people and get the message through...*' (Int3)
>
> '*...each team can see what the other team is doing...*' (Int14)
>
> '*...you don't deviate from a conversation...*' (Int26)
>
> '*...there was a lot more personal contact ...e-mail has taken that away...*' (Int7)
>
> '*...people can hide behind e-mail...*' (Int20)

Sometimes there could be apparent contradictions within the data from one respondent. For example, a production operator talked of the computer causing duplication of work, in the sense of having to keep both paper and electronic records, but also said that the computer saved time; an administrator said that the computer enables communication with many more people, which is advantageous, but that the loss of personal contact occasioned by e-mail was a disadvantage.

Question 1.3 What computer skills are essential for you to do your job?

This aim of this interview question was to discover how people perceived their own computer needs with respect to their work. The initial reactions to the question are summarised in table 5.7 below:

Response	A-D	E-G	Total
Use of a specific package	1	9	10
Specific action such as booting up	2	3	5
Typing/keyboarding	4	1	5
General skills: input data, interpret data	2	1	3
Open mind, lack of fear	1	2	3
Training, help from an individual	3	0	3
Know how it works	1	0	1
Total	14	16	30

Table 5.7 Initial reactions to question 1.3

While the majority of respondents referred to specific packages or actions, equating these, or their use, with skills, it is notable that three respondents mentioned affective areas: having an open mind and lacking fear. Two of these were from the managerial groups. The implication seems to be that the majority of the respondents equate their skill needs directly to their job.

The further analysis of the responses, using the categories in the coding dictionary, is summarised in table 5.8 below:

Code	Meaning	A-D	E-G	Total
Typing	Use the keyboard	9	10	19
Applications	Ability to use Word, Excel etc	4	11	15
Feelings	Confidence, lack of fear	7	5	12
Navigate	Finding your way around Windows etc	2	4	6
Know	Background knowledge of how computer works	2	4	6
Manip	Opening, saving files etc	2	3	5
Maint	Computer maintenance	0	1	1
Train	Training	1	0	1

Table 5.8 Responses to question 1.3

While initial responses related to specifics, such as software packages like Access or actions like booting up, further analysis revealed more comment about keyboard proficiency and whether it was essential; opinions were evenly divided on this. Also, 12 respondents mentioned affective factors. I categorised the responses into three groups: computer-related skills such as navigation or using specific applications, generic skills such as keyboarding and affective factors such as confidence and lack of fear. These are summarised in table 5.9 below:

Responses	A-D	E-G	Total
Computer-related	10	23	33
Generic skills	9	10	19
Affective factors	8	5	13

Table 5.9 Skills categories

Computer-related skills dominate the thinking of the managerial groups but affective factors are almost as important as computer-related and generic skills for the non-managers.

The requirement for skills, however they are conceptualised, leads to the central questions about learning (2.1 to 2.3), but it is also interesting to note the connected discussion of qualifications. During the general discussion

following question 3 of the interview schedule, respondents felt that qualifications and courses were less important than experience, more so in IT. According to one respondent (Int1) this is because the IT world changes so quickly. However, for one respondent there was a value in qualifications as an indicator to an employer, to prove their knowledge (Int4), but for another, qualifications did not necessarily show that someone could *use* IT (Int8).

The data from this question and from interview questions 2.1 to 2.3 informs the third research question, that of how people learn to use computers, one of the principal themes of the study.

Question 2.1 How did you begin to learn about computers?

This question does not readily admit multiple answers, as it is a closed question. The responses were categorised according to the four labels explained in the coding dictionary and a quantitative count is shown in table 5.10:

Code	Meaning	Total
Shown	Demonstration by a colleague	10
Formal	Taught formally at school, university or college	9
Self-taught	Learnt autonomously and informally by personal exploration and perhaps reading manuals	7
Training	Received some form of workplace training	4
Total		30

Table 5.10 Responses to question 2.1

One-third of the respondents learned to use a computer from a demonstration in the workplace ('Shown'), slightly more received either some kind of formal instruction at school or college ('Formal'), or through training in the workplace ('Training') and slightly fewer taught themselves to use a computer ('Self-taught'). I then expanded this to show the split over the work groups as follows:

Code	A-D	E-G	Total
Shown	6	4	10
Formal	2	7	9
Self-taught	4	3	7
Training	2	2	4
Total	14	16	30

Table 5.11 Breakdown of responses to question 2.1

This is not an indication that more formal education or training is available to the managers than to the non-managers at Upworld, as this question refers to initial learning, which may have been, and in many cases was, not at Upworld but at school, college, university or in another workplace.

The next step was to look more closely at the range of experiences within each of these categories. The four respondents (3 male, 1 female) whose first learning experience of computers was through training were all long-serving employees whose training was provided by Upworld. This took the form of half-day or one-day courses in the basic applications Excel, Word and Access. They described the training as:

> '*...the very basics...*' (Int7)
>
> '*...putting information in but not putting some kind of system together...*' (Int15)
>
> '*...the beginners' course...*' (Int18)
>
> '*...small bite-size chunks of knowledge and information...*' (Int19).

This training was originally a mix of off-site and on-site provision, and one of the four, who attended an off-site course, remarked that he felt 'flustered' at colleagues who could progress faster than him (Int15). He was nervous at the time about doing the course, but one of his colleagues on the course was '*...about the same level as [himself]...*' so he agreed to go. There are issues here of comfort and feelings of intimidation, which surface again in the discussion following question 3.

Those who were self-taught (all male) talked of a variety of motives: a problem at work, prompting by children in the family, wanting to play games, as a hobby because it was the current craze, and because computers were appearing in the workplace. Those whose initial learning was formal are predominantly in the managerial groups, though not necessarily in the young age group. Four of the nine *were* in the young age group and had learnt at school; one (Int27) had attended an evening class, the only respondent to do so; three, all with an engineering background, learnt formally at university; and one (Int1) had done paper exercises in programming at school in the late 1960s. The other method of initial learning was demonstration by a colleague, the method referred to in training and HRM literature as 'sitting with Nellie'. This group included four of the females in the administrative group and one of the female managers in group G. In the case of the four administrative staff, the initial experiences were all concerned with simple sequences of keystrokes to input data. This also applied to one of the production workers. The other production worker said that everything that he had learnt on computers had been passed to him as a part of learning the job.

Although the question about initial learning had a single answer, even here the complexity of learning was beginning to surface, as respondents described how their initial learning experiences were supplemented. For example, the production worker who went to an evening class quickly augmented this learning when his wife taught him how to use different applications and how to extend his knowledge. One respondent taught formally at school (Int21) was also shown other applications at home by his mother, who was a teacher. The production worker who had received training found that '*...really I think I taught myself more than anything...*' Another respondent learning formally at school supplemented this at home through self-instruction and play. This emerging complexity suggested the idea of personal patterns of learning, to be developed in the analysis of the next question.

Question 2.2 How have you learnt new computer skills more recently?

The complexity referred to in the previous subsection surfaces in the responses to this question. A count of initial responses was inappropriate here so I began by carrying out a count of strategies, categorised according to the coding dictionary. The summary is shown in table 5.12:

Code	Meaning	Total
Talking	Asking other people, usually colleagues or friends.	28
Self2	Personal learning, for example, exploration or by trial and error.	21
Inhouse	Training at Upworld, usually onsite, but sometimes at the company's American headquarters or with a private training company.	21
Observ	Watching others at work	6
Manuals	Reading books and manuals	4

Table 5.12 Responses to question 2.2

The codes here differ from those used in the analysis of the previous question. *Shown* in question 2.1 referred to initial demonstration by a colleague, which is not applicable to current learning, but I found the occasional mention of watching others, so this became *Observ*. Also, *formal* was no longer applicable, as no respondent was currently undertaking any formal, external course. *Self-taught* became *Self2*. *Training* in question 2.1 referred to initial training courses, so in the analysis of question 2.2 data, this was changed to *Inhouse* because any current training would be within Upworld, whether on or off site. I used two additional codes: *Talking* and *Manuals*. The former refers to any mention of asking others or sharing knowledge with others, the latter to reading computer manuals. Expanding table 5.12 to show the split between work groups gives the following:

Code	A-D	E-G	Total
Talking	13	15	28
Self2	8	13	21
Inhouse	10	11	21
Observ	4	2	6
Manuals	0	4	4

Table 5.13 Breakdown of responses to question 2.2

The complexity issue arises because, as tables 5.12 and 5.13 indicate, people may be using more than one learning strategy. In my further analysis I temporarily excluded the category *Inhouse*, since I was becoming more interested in how people were learning on a daily basis, coping with using the computer in an ongoing way. This is something that training cannot do, being planned and pre-determined. Looking first at the number of strategies used, I found that no one used all four, eight used three strategies, 13 used two and nine used one. The split between work groups is as follows:

Number of strategies	A-D	E-G	Total
3	2	6	8
2	7	6	13
1	5	4	9
Total	14	16	30

Table 5.14 Number of learning strategies identified by respondents

I then looked at what people thought of the various strategies, including the training provided at Upworld. Five respondents preferred training for a number of reasons: it provided the basics; it gave access to expertise, particularly where the package was a specialist engineering one; it was learning at a relaxed pace; and it could overcome initial fears. Some illustrative comments are as follows:

> '*...if you have a question, there and then, the person who's carrying out the training can normally answer your question...especially with Auto cad...*' (Int5)

'...[it's] a specific course for a specific function...' (Int16)

'...to get us on board, to get us up and running...' (Int19)

'...[it's] very relaxed learning...'(Int15)

'...training would be a good starting point for a lot of people because a lot haven't got a clue about [computers]...' (Int23)

However, opinions of these courses were mixed but one consistent theme was that their effectiveness, or rather lack of it, was a function of their timing and the relevance of their content:

'...It's excellent as long as you're going to use the package afterwards. When I first started Excel, I did a course in Excel and it was really good, but in the job at the time we didn't use it a lot so with packages like that you forget the different things...' (Int4)

'...unless you're using certain skills all the time you tend to be trained on something one day and if you don't use it for 6 months, for instance, then to my mind you're back to square one...' (Int19)

'...the type of training [the trainer] was doing or the type of spreadsheets [the trainer] was asking us to do were absolutely no relation to the work in here...' (Int14)

'...to be honest it didn't really do any good because...we were getting trained on Access, it's like every database is different and what they were teaching us wasn't applicable to this database at all...' (Int9)

Training was felt to be only of use for either a basic introduction or for refresher courses, It is ineffective when, according to int5 *'...one of those messages is hoyed [thrown] at you that no-one understands...'* occurs. Here, you either ask for help or try to solve it yourself. Either way this is informal learning.

For those who mentioned talking to others, some saw it as equivalent to consulting a perceived expert and they sometimes named the individual:

'*...when anybody gets stuck they shout for [colleague] or [colleague]...*' (Int2)

'*...failing that it will be the technical guys who I know have extensive PC knowledge: the likes of [colleagues]...*' (Int5)

'*...the typical reference is [colleague]. He's the type of feller, he's either learned it or is self-taught...*' (Int11)

The number of individuals named was small but one name that was mentioned several times was that of respondent number 1. His professional role is that of environment manager at Upworld; he is not an IT expert nor does he have any role in IT support at the factory but is seen by his colleagues as someone who knows a lot about computers and enjoys working with them. The plant manager, respondent 28, described him as one of the 'masters'. This gave me the idea of asking this respondent to keep a diary of occasions when colleagues asked him for help or advice on computing matters. This material is referred to later in this chapter.

Sometimes talking as a strategy is allied to an informal demonstration of something:

'*...myself and [colleague] compare notes on a regular basis- is this the way to do this or is there an easier way?...*' (Int7)

'*...I've sat with people before when they've asked me to calculate something and I've calculated it on my computer to give them the answer and they've said "Oh, I've never seen that, how did you do that?"...*' (Int8)

'*...somebody might see you putting figures in and say 'I know a better way or an easier way...*' (Int22)

'*...if somebody says 'how do you do this?' they'll get up, come to your desk and show you how to do it...*' (Int26)

The code *Self2*, personal learning, was interesting for the number of images that it produced to describe the strategies that people used. These included exploration, investigation, trying, trial and error, practice, struggling,

tackling, picking up, doing, searching, pushing boundaries, figuring out, sussing out, playing, experimenting, juggling and messing around. Some of these suggest a methodical approach, some a less structured method. There was a general impression that learning for yourself was a necessary way to consolidate knowledge:

> '*...after [formal education] to get you familiar with the scope of the package...it's largely up to you as to how much you practise and how much you learn...*' (Int2)
>
> '*...the more you struggle the more you learn because you don't forget when you've struggled... You'll never learn anything watching...because you'll never remember where to look for things...*' (Int3)
>
> '*...if I find out how to do it myself I'll probably not forget...*' (Int10)
>
> '*...you've got to get on and do it and that's when you start learning...*' (int11)

With one exception, the comments concerning observation were related to picking up hints or tips rather than any more substantial learning, and for one respondent it was almost an alternative to talking. For example:

> '*...it's just the shortcuts, watching people...*' (Int4)
>
> '*...I was watching [colleague] in there and I said 'How do you get those little ticks?... You see someone use it and you think 'I'll remember that"...*' (Int18)
>
> '*...if someone comes round I'll take notice of how they do it so I won't have to ask again...*' (Int9)

The exception was one of the junior managers who needed to cover the job of a colleague and in order to learn it, he watched her as she proceeded through the relevant software package, a specialist database, carrying out typical tasks. Then he watched again, this time taking notes and asking for explanations. It could be argued that this was an example of him being shown how to carry out the tasks, of 'sitting with Nellie', but it was a sophisticated example that involved guided learning, observation and note taking.

Opinions on computer manuals were mixed. One extreme was represented by the comment '*...I've seen computer manuals and I don't go there...*' (Int19). The other extreme was ironically expressed: '*...I was very privileged to be able to find a manual...*' (Int11), followed by the admission that his copy was his main reference, and a demonstration showed it to be well-thumbed and annotated. Criticisms of manuals were that they are not explanatory (Int16) and are untrustworthy as sources of information (Int14). However, for a minority of respondents, a manual is a learning tool.

The next question on the interview schedule was, in a sense, an extension of, or probe for, this one. I wanted to explore what people's strategies were when they had specific problems.

Question 2.3 How do you solve any problems that you have with the computer at work?

In my analysis of this question I categorised the responses according to the coding dictionary as shown in table 5.15 below:

Code	Meaning	Total
ITM	Asking the IT manager for help	19
Ask	Asking colleagues for help	17
Selfsolve	Solving problems alone	11

Table 5.15 Responses to question 2.3

Respondents might use one, two or, in the case of one production operative, all three of these strategies. The respondents seemed to interpret the question about problems as related to hardware, and would ask the IT manager or an 'expert' colleague about such problems. They tended to consult immediate colleagues more when they had software problems. The strategies that people adopted to avoid problems included the use of floppy disks to back up work, making notes in a book and using a personalised manual. There was recognition by respondents that the IT manager's job was not entirely devoted to solving problems. He was '...a last resort...' because he was so busy (Int1); he had limited access to people (Int2); he dealt only

with hardware or technical problems (Int11); or was not able to provide answers quickly (Int3).

Several respondents mentioned a queuing system that operated for formal requests for help from the IT manager and said that because of this, they preferred to ask a colleague for help or try to solve problems alone. Some illustrative examples are:

> '*...I'd go to [colleague] because of their specialist knowledge...*' (Int6)
>
> '*...I'd probably go to [colleague]...I think she is expert...*' (Int26)
>
> '*...I ring one of the masters...*' (Int28)

Implicit here is the recognition that knowledge of and ability with computers cannot be confined to a specialist department, that there is a necessity for someone such as the respondent diarist to be able to solve problems relatively quickly in order for people to continue working.

One of the categories developed for coding the discussions in question 3 of the interview schedule was that of *Best method*, where someone expressed a preference for a particular learning strategy. There was a mix of preferences, among both managerial and non-managerial groups, for informal learning with more structured support, formal training with experts, trial and error, one-to-one training, and demonstration, followed by practice and writing notes. Some examples are:

> '*...I don't think it has to be formal. I think it needs to be practice...people almost interacting, just talking: "Have you tried this? Have you seen this?" but it needs to be a little bit more structured...*' (Int2)
>
> '*...I think the best learning method is to go on a specific course for a specific function...*' (Int16)
>
> '*...The one day courses are good but because it's a set structure I would prefer to go away and try a particular skill for an hour or two then come back...*' (Int17)

'...I would say one-to-one with somebody, that's the most effective way...' (Int7)

In my further analysis of the data related to questions 2.1 to 2.3 I began to look for more conceptual categories. Much had been said about talking to people, whether in the context of simply asking for help or of broader discussion of problems. It occurred to me that the learning experiences and strategies might be viewed on a spectrum from the proactive to the reactive. Proactive experiences are those where the learner takes the initiative: seeks training, asks people for help or explores software using a manual or onscreen help. Reactive experiences are those where training is imposed or consists of demonstration by a colleague. Applying these conceptual categories of proactive and reactive learning strategies to the responses to questions 2.1-2.3 I found that two-thirds of the respondents were generally proactive in their learning strategies, a proportion that was replicated in the managerial group. A summary is shown in table 5.16:

	A-D	E-G	Total
Proactive	8	12	20
Reactive	6	4	10
Total	14	16	30

Table 5.16 Proactive/reactive learning strategies

Examples of proactive learners are Int23 and Int21. Int23 is a production worker whose initial learning was self-directed, reading a computer manual, and who now prefers talking to colleagues and perceived experts. Int21 is a technical supervisor whose initial learning was formal, at school, and who now favours trial and error, and consultation with colleagues. Examples of reactive learners are Int10 and Int15. Int10 is an administrator whose initial learning was by demonstration, and who has subsequently attended short training courses but who asks for help rather than trying to solve problems herself. Int15 is a production manager whose initial learning was in the form of training on short courses provided by Upworld and who now, like Int10, prefers to seek help rather than trying to solve problems himself.

Question 2.4 Do you use a computer at home? For what?

This question, together with some of the data from the questions 2.1 to 2.3, informs the fourth research question concerning transfer of learning between home and work. The question referred to *access* to and *use* of a computer rather than ownership. Four respondents had no home access to a computer. A further four did not own a computer but either had one loaned to them by the company or lived with someone who owned one, and thus had access. In the analysis of this question, initial responses seemed unhelpful, so for a first level of analysis I looked at the frequency of the use of a computer at home. I used three categories: the extremes of *never* and *regular*, where the latter meant using the computer most days, and *occasional*, which meant anything in between these extremes. A summary of the results is given in table 5.17 below:

Frequency of use	A-D	E-G	Total
Regular	3	7	10
Occasional	8	7	15
Never	3	2	5
Total	14	16	30

Table 5.17 Frequency of home use

The 'never' category includes the four respondents who had no home access, but one other respondent, Int24, said that he never used the computer in his home. It belonged to his wife and he was afraid of damaging it after an initial experience when the screen froze. A majority of respondents from both non-managerial and managerial groups use a computer at home, with daily use more common among those from the managerial groups and occasional use evenly spread. I looked at the reasons given by those in the *occasional* category who used the computer at home, but not often. I found five respondents whose use was rare. In three of these cases, the respondents either no longer needed to use the computer for work or they equated it with work and were reluctant to use it at home:

> '*...I found it easier to do the appraisal at home away from the work environment... Well, I don't do that now...*'
> (Int15)

'*...Whereas some people would spend a lot of time in their recreation time on a computer, I don't see it as leisure...I do enough in my mind during the day on the computer...computers to me mean work...*' (Int19)

'*...I've been using it for my stock graphs but then they were taken out of my hands...*' (Int25)

I asked those who had no home access why they did not have a computer, and they talked about cost, personal circumstances or again, about equating the computer with work:

'*...I bought a computer for my son a couple of years ago but separated from my wife so he's got it...*' (Int11)

'*...I have toyed...with the idea of getting a computer then I try very hard to balance the amount of money I would spend on computer to what use I would make of it and I haven't been able to balance that out yet...*' (Int14)

'*...because I work on them all day long and I've got absolutely no interest...*' (Int20)

When looking at the nature of the usage, I found that many of the 26 respondents who had home access used it for more than one activity. A summary, using the categories from the coding dictionary, is shown below:

Code	Meaning	A-D	E-G	Total
Internet	Surfing Internet, shopping etc.	5	9	14
Work	Doing work tasks at home	5	7	12
Leisure	Playing games	3	6	9
House	Accounts, budgeting	2	5	7
Study	Course assignments	1	0	1

Table 5.18 Nature of home use

Use of the Internet and use for work tasks are predominant. Respondents were using the Internet as a research tool to find information about holidays or their interests; they were booking holidays and shopping; downloading music; and betting. The results show a relatively high level of home use of

the computer for work purposes by 12 respondents, in the non-managerial production groups as well in the managerial groups. This use included accessing e-mails, and preparing presentations and reports. There was also use for leisure, for example, playing games and using digital photography software and for household tasks such as budgeting or keeping records of household expenditure. One respondent used her computer to prepare course assignments.

Question 2.5 Do you like working with computers?

This and the previous question help to inform the second research question concerning computer literacy and how people feel about the computer. In their replies to this question the respondents expressed varying degrees of enthusiasm, or lack of it, for the computer. Some said they loved using a computer, others found it fascinating or interesting, some were neutral or diffident. Initially I used three broad categories to analyse responses: positive, neutral/having mixed feelings and negative, and found that a majority of respondents across the work groups were generally positive or neutral in their view, with only one person expressing a wholly negative view. A summary is given in table 5.19:

Reaction	A-D	E-G	Total
Positive	9	11	20
Neutral	4	5	9
Negative	1	0	1
Total	14	16	30

Table 5.19 Attitudes to the computer

Some illustrative examples of reactions in each category are as follows:

Positive:

'*...It's something about them...It's like a friend...*' (Int13)

'*...I think it's interesting and it's not until you get into it that you realise how good they actually are...*' (Int22)

'*...I wish I could work with them all the time...I'm just fascinated with them...*' (Int23)

'*...Yes, I just find them fascinating...really interesting...*'
(Int27)

Neutral:
'*...I don't mind them, they're just a tool for the job...*'
(Int29)
'*...I'm not bothered one way or the other...*' (Int25)
'*...I wouldn't say I liked or disliked them...*' (Int14)

Negative:
'*...No. Insecurity I think...basically they terrify me...*'
(Int26)

I then looked more closely at the reasons that people gave for their feelings. The respondent expressing a wholly negative view (Int26) also spoke of her fear of the unknown and said that she was '*...not very technically minded...*'. Another respondent, whose attitude was generally neutral, also expressed fear of them: '*...I'm terrified I'll break it...*' (Int24) but this was a reference to the computer in his home, an expensive model owned by his wife. Some of the reasons given were affective: fascination, pleasure, interest, and challenge, while some were more practical, for example, speed and help with spelling and letter writing. Some respondents spoke of the computer in anthropomorphic terms: as a friend (Int13), as his assistant (Int3), as temperamental (Int23), stupid (Int20) or clever (Int9), while others regarded it as a tool. There were also expressions of frustration, regardless of general attitude, with faults in the machines or the software, slow response times, technological complexity and the respondents' frustration with themselves:

'*...I certainly get annoyed when...there's a link problem between the computer and the printer...*' (Int11)
'*...sometimes it can be very, very slow...*' (Int26)
'*...it was never straightforward, and as time has gone by, they have got more complicated...*' (Int1)
'*...I get frustrated when I can't do things...*' (Int7)

Although I have not looked at discourse analysis or the affective domains specifically in my theoretical discussion, this analysis does raise suggestions for further reading and research, to which I have pointed in the final chapter of the dissertation.

I also noted some apparent contradictions. For example, one production manager enjoyed using his computer at work but rarely used one at home because he thought it would be boring to do so. Another respondent (Int29) said that computers were good, because they brought people together through e-mail, but that they were bad, because they isolated people and there were too many e-mails. These are different dimensions, since e-mail does bring people together in the virtual world but computers can isolate people in the real world.

Data from two areas of the general discussion that followed from question 3 of the interview schedule (see later) also helps to inform the discussion of attitudes to the computer, so I want to include that data at this point. The first area concerns the perceived advantages and disadvantages of personal computers. A general summary of these is shown in table 5.20:

Group	Advantages	Disadvantages
A–D	Accuracy and speed	Pressure on the workforce
	Better company performance	System failures, unreliability
	Make the job easier	Too much information
	Storage of data	Time consuming
	Less paperwork	Programming problems
	Save thought	Over reliance
	Improved communications	Lack of personal contact
	More information available	They don't give feedback
E-G	Reduce tedium of tasks	More work for individuals
	Less paper	Dependency
	Manipulate, analyse and present data	They can't make judgements
	Benefit to businesses	Loss of human element
	Speed	They deskill
	Enable communication	Create a 'digital divide'
		Badly designed keyboards
		They tie people down
		Business dependent therefore vulnerable
		They take over lives

Table 5.20 Summary of views of computer (from general discussion)

Some factors, such as speed or data storage, were mentioned by more than one group. Notably, in the company context this could be an advantage, in terms of better company performance, and a disadvantage, when the business was over-dependent on the computer. For example, if the network system went down, the customer service administrators in group D would be unable to work. Three respondents, all managers, said that computers had no disadvantages.

The second area from the general discussion supports the high level of home use of the computer and concerns the aspirations of some of the respondents to build on their computer learning and acquire new knowledge and skills. This was expressed in both general and specific terms:

> '*…I'd always thought that if I don't do something myself, I'm going to be left behind so [the computer] was a knock*

on the door for me...I knew things were advancing and I certainly didn't want to be left behind...' (Int27)

'*...I'm sort of in the process of teaching myself digital photography and the manipulation of images...*' (Int1).

The respondents' expressions of desire to learn new aspects of computer use included some related to work, such as networks, touch typing, formatting and particular software packages, but others did not: building a website, programming, using the Internet to trace friends, and acquiring a level of confidence with computers. Some, however, had no desire to learn anything further:

'*...I have no desire to learn new skills as I have a lack of vision; maybe I should learn some...*'(Int6)

'*...I think I've got as much information as I need to do the job at present...*' (Int26).

Question 3 Do the questionnaire results surprise you? Discussion of computer literacy

The final question of the interview schedule, along with questions 2.4 and 2.5 informs the second research question concerning computer literacy. For this final question, respondents were shown the results of the phase 1 questionnaire (table 4.4) and asked to comment on the rankings. This led into a discussion of their views of computer literacy. I had initially categorised these under a single code *CL*, as people gave several responses to this, and they were not easy to tabulate. As I read through the data again, various perspectives emerged so I applied a basic count to these. A summary is shown in table 5.21:

Perspective: computer literacy as ...	A-D	E-G	Total
Related to the needs of the job	4	7	11
Knowledge of computers	6	3	9
Software proficiency.	2	7	9
Task proficiency	3	4	7
Affective factors, such as lack of fear	3	4	7
Levels of ability	0	6	6
Ability to communicate	1	3	4
Programming	2	0	2
Producing something, such as a document	0	2	2
Logic	0	1	1

Table 5.21 Summary of responses to question 3

Knowledge of computers was a more important indicator for non-managers, while levels of ability were important only to the managers. Some illustrative examples of each category are as follows:

Computer literacy as:	
Related to the needs of the job	'*...getting what you need from the computer to do your job...*' (29) '*...it depends on what your job is and what you need the computer for...*' (9)
Knowledge of computers	'*...a good understanding of the computer system...*' (22) '*...Knowledge of computers, how to use them, write programs...*' (25)
Software proficiency.	'*...competent at using a wide range of software programs...*' (7) '*...use and communicate with all the standard packages...*' (2)
Task proficiency	'*...turn on, use the Internet, send e-mails...*' (21) '*...turn it on, open files up, enter data, save it...*' (20)
Affective factors, such as lack of fear	'*...someone who is comfortable using a PC... if you're frightened of it how can you be literate?...*' (12) '*...comfortable or confident...*' (2)
Levels of ability	'*...You've got one standard which is 'not computer literate... after that there are different degrees...*' (21) '*...There's a progression...*' (3)
Ability to communicate	'*...being able to use e-mail to effectively communicate...*' (5)
Programming	'*...some sort of programming ability...*' (7)
Producing something, such as a document	'*...to produce a written document in Word...*' (2)
Logic	'*...Logical thought, how to perform a task...*' (11).

Table 5.22 Examples of perspectives of computer literacy

Although the perception of computer literacy as related to the needs of the job dominated the discussion, one respondent (Int23) disagreed, saying that it was not related to the majority of jobs on the shop floor. This prompted me to return to the data to look for other examples of what was NOT perceived as computer literacy, and I found the following:

Computer literacy is not...	
Fragmentary knowledge	'*...I don't think you can class yourself as computer literate if you just know bits and pieces...*' (Int22)
Design	'*...I don't think you should need to be able to design spreadsheets... or web pages...*' (Int20)
Intelligence	'*...a computer literate person might be somebody who's got the basic skills ... but they mightn't be intelligent...*' (Int10)
Using the Internet	'*...it's not a Web thing...*' (Int6)

Table 5.23 What is not computer literacy

One respondent commented that computer literacy was not connected to print literacy because access to computers is not as universal as access to print media:

> '*...once you can read English, you can read English...but you might be able to use Word pretty proficiently but not have a clue what a database was all about...in computers there are multi-skills...*' (Int1)

Other respondents said that there could not be a standard because everyone uses a computer in a different way (Int3) and a standard would be difficult to set, especially if people used computers more at home than in their work (Int27).

Summary of interview data

The analysis of the interview data has produced a number of issues that will be discussed in the next chapter. In summary, it has confirmed that computer usage at Upworld is largely dictated by the jobs that people do and suggested that one of the most important changes is to communication. The respondents seemed to relate their computer skill needs directly to their jobs but some had mentioned affective aspects of computer use. Computer literacy was perceived of in a number of ways, the predominant view being that it was linked to the needs of the job, but the computer skills that people have are used in the home as well as in the workplace. The analysis showed a variety of strategies for learning, many of them informal and there was a

strong indication of the need to consult people for advice and help. The next subsection deals with the analysis of the diary kept by one such source of help.

Analysis of the respondent diary

The diary was kept by Int1, who is my husband. I realised that there were advantages and disadvantages in getting him, as opposed to any other respondent, to do it. It might be that he would provide richer data in an effort to help me, but it might also introduce a certain bias in that he might try to anticipate the data that I wanted. This point is taken up in the discussion in chapter 6.

The respondent kept a diary for the year from mid-November 2001 to October 2002. Initially, as with the interview transcripts, I carried out some basic quantitative analysis on the entries. The 65 entries could be categorised as shown in table 5.24:

Type of entry	Number
Questions to or requests for help from the respondent	58
Discussions between the respondent and other 'experts' or occasions where the respondent learned something himself	3
Logic problems.	4
Total	65

5.24 Summary of diary entries

The entries classified as logic problems were problems with calculations within a spreadsheet caused by the use of incorrect formulae. Of the 58 requests for help, the respondent was able to deal with all but two. These requests could be further categorised as shown in table 5.25:

Type of request	Number
Fixing the problem for the enquirer	25
Working with the enquirer to solve the problem	23
Providing some form of extended explanation or training	10
Total	58

5.25 Analysis of requests for help

Illustrative examples from the diary are as follows:

Fixing the problem	'...[*Colleagues*] asked for help to change their network login passwords...made a one line batch file to achieve this and located it on the desktop...' (23.1.02)
Working with the enquirer	'...[*Colleague*] asked for help because the icons on his MS Office toolbar had changed and were all the same wrong icon....We looked first on the short cut toolbar's 'customise' menu...then I went back to my PC and found the command...I then went back to [*colleague*] who was still looking for it...' (20.11.01)
Explanation or training	'...Gave [*colleague*] 5 minutes off-the-cuff training on how to create a new slidemaster in PowerPoint... (1.8.02)

Table 5.26 Examples of problems.

On looking at the entries in more depth I noticed that in 43 cases (74%) the respondent was able to solve the problem or answer the question immediately. I looked for situations where there was more than a simple answering of a question or problem-solving, and found some evidence of collaborative work. He used phrases like *'we looked for...'* and *'we changed the macro...'* on six occasions but it was noticeable that in all but one of these cases, the other individual was one of the other perceived experts at Upworld. None of this expertise is captured in any sense and in several entries the respondent refers to his own reliance on memory: '*...I remembered I had seen this before...*'(20.11.01) and '*...I'd had a similar problem...*' (21.11.01)

There was an example in the diary of informal learning by collaboration in the three discussion entries. The respondent and two colleagues had started

to design a production database some time ago and were meeting to discuss aspects of this project. They explored the problems together and discussed solutions, and the respondent remarks:

> '*...interesting how the three of us came up with much better solutions than any one of us would have had working alone...*' (9.9.02).

Neither the respondent nor his two colleagues have any responsibility for IT development or support at the factory and were carrying out this exercise in addition to their normal jobs. Given that the respondent is by no means the only person whom people at the factory consult about their computer problems, these snapshots of an informal learning situation support the view that people at Upworld need and use learning opportunities and strategies over and above those provided by training courses and the presence of the IT manager.

Summary

This chapter has presented an account of the second phase of the study, including its relationship to the research questions, the design and piloting of the interview schedule, the sampling strategy employed in the selection of respondents for interview, the conduct of the interviews and the analysis of the interview transcripts and diary entries.

In summary, the analysis of the interview data has helped me to confirm some of the questionnaire data concerning usage of computers at Upworld. It has suggested that informal computer learning is important at Upworld, and has provided detail about the learning strategies used. This detail suggests that there are personal patterns of computer learning using a variety of strategies: formal education, training, demonstration, self-directed exploration, talking to others and so on. The diary and the interview data together, indicate reliance by some learners on perceived experts such as the respondent diarist. These points are taken up in the next chapter, which presents a discussion of the findings from chapters four and five in the context of the literature review.

Chapter 6 Discussion of the results

Introduction

The aims of this research study are to explore the themes of computer literacy and learning by asking about the following: how computer technology has affected individuals in the workplace; what individuals think computer literacy means for them and how they feel about the computer; how people learn to use computers; and whether their learning is transferred in any way between home and work. Chapters two and three presented, respectively, a review of the literature relevant to the themes of the research study and a discussion of its methodological aspects, while chapters four and five presented analyses of the data gathered in the two phases of the study. This chapter presents a discussion of these findings and, using the research questions as subsection headings, some suggested answers.

Earlier I commented on the ethical issues surrounding my connection with Upworld, in that my husband is employed by the company as a manager. I was concerned about the possible effect on the quality of the data and whether people would be less than forthcoming in the interviews (see page 71). However, during the interviews I found that people were not slow to criticise either the management or the training provision, and I do not think that my position had a detrimental effect on the quality of the data obtained. I also considered the effect on the diary data of asking my husband to act as a respondent diarist: whether the data would be biased in any way if he tried to anticipate what I wanted (see page 127). When analysing the data from the diary, I found myself, like Nias (1993), slightly disappointed at the occasional terseness of the entries (see page 68). The diary data was useful but I did not feel that my relationship with the respondent had led him to extrapolate the data in any way.

How has computer technology affected individuals in the workplace in terms of the work itself and the way they work?

The analysis of the data from the questionnaire relating to computer usage and from the responses to the first three questions of the interview schedule showed both expected and unexpected results. The overview of usage from the questionnaire showed, perhaps as expected, widespread use of personal computers at Upworld but with greater general use in some functional departments and greater use of e-mail and the Internet among the managerial groups. When exploring this further in the interviews, I had expected some relatively straightforward themes to emerge in answer to the first interview question about usage of the computer at work. I had expected responses such as '*...inputting data...*' or '*...managing budgets...*' but not those such as '*...Access...*' and '*...Excel...*' because these responses give information about *what application* is used rather than the use of the computer. The complexity of computer use is reflected in how difficult it is for people to provide a single answer to this question. Applying Conlon's (2000) typology of the technician, craftsman and visionary to the analysis of the replies to the first interview question, I found that most respondents replied in terms of the technician or craftsman, mentioning specific applications, inputting data or communications. Only two respondents, both non-managers, stated what they used the computer for:

> '*...keeping control of stock...*' (Int13) and '*...production planning...*' (Int20).

Unsurprisingly, computer usage at Upworld is driven by workplace needs; the data suggest that as an individual's usage of the computer increases and/or becomes more varied, their description of that usage is likely to be phrased in terms more of the machine than the job.

Computer usage at Upworld reflects, to a certain extent, the widening gap between intellectual, technical and manual work suggested by Aronowitz and Difazio (1994). For example, project managers and engineers use computer-aided design software that requires specialist knowledge, while

the production operatives use computers in a manual sense to input data. Illich (1973) had argued that tools needed to be convivial, that people need tools that they could work *with,* rather than tools that worked *for* them. Comments of three respondents who worked with the purchasing and stock control software might suggest that the latter situation is the case:

> '*...it's a nightmare...*' (Int4)
>
> '*...it dictates to us how we pick a load for the customer...*' (Int13)
>
> '*...all distribution functions are all controlled within [the software]. It flags up when something's gone wrong...so really it's just an extension of your brain...*' (Int16)

These phrases suggest that the tool, in this case the software, is perceived to be in control.

The data show that the computer has brought about changes to work and to the way that people work at Upworld. Those with less complex jobs, in the warehouse or in maintenance, talked of the computer making work easier by saving time and paperwork, and improving accuracy. Those with more complex, managerial roles also talked of the effect of computers on data storage and analysis, and on their general working lives. While their immediate response to a question about their use of the computer might be to name the application, when talking about the changes brought about by computers, the answers were more considered. A major effect on the way that people work was the change in communication, mentioned by 28 of the 30 respondents. They spoke of communication in different ways: as a method, (e-mail, fax, telephone or conversation), as a process of giving information and as an alternative to seeing people face to face, but only six respondents talked, at this stage of the discussions, of the benefits usually ascribed to computers, such as better data storage and access to information. The effect of the computer was seen more in terms of an alternative device than a better tool. For example, e-mail was an alternative to the telephone or fax, but not necessarily an improvement. Illich's (1973) crisis of a dominion of industrial tools may not have arrived, but only because currently, some

respondents believe that uncertainty cannot be managed by computers and judgement is needed:

> '*...as far as I am concerned the computer will only do what you tell it to do...*' (Int7)
>
> '*...whether you're on paperwork or whether you're on a [computer] system the judgement has to be there. You've got to know what you're looking for...*' (Int26)

Two others, however, took the opposite view:

> '*...you used to do 'seat of the pants' judgements. I think you can analyse data much better and faster...that's a better basis for making a judgement...*' (Int3)
>
> '*...before we had the computer there wasn't really any colour checks as such, so it was more like visual...now, even looking at it, you wouldn't be able to tell until you had done your check, put your figures in, it's more accurate definitely...*' (Int22)

Technological change at Upworld has had an impact on day-to-day aspects of the respondents' lives, although those respondents young enough to have always known computers did not see the changes. People may perceive that they have less or more paperwork, can organise meetings better using a computer conference, miss the face-to-face contact or that their working life has been made easier or harder. This does not, however, mean that they have become the symbolic analysts of Reich's (1992) new world of work. In some ways Upworld is a Fordist factory as defined by Brown and Lauder, (1999): it has an assembly line and specialist machinery. However, the assembly line produces a range of similar products rather than a single standard item. Production operatives are not required to have any tacit skill in the handling of the product. Although the time-critical elements of the assembly line are automated by a type of computer called a programmable logic controller, the operatives are needed to keep the automated process running and to carry out manual work involved in item changes and offline quality checks. As a result of the latter, the production staff input data into a personal computer network.

In the interviews, I used the word *skill* without any particular indication of the multiplicity of meaning that can be ascribed to the term. I had no preconceptions of how the respondents would interpret the word. My analysis shows that perceptions of their computer skill needs among the respondents at Upworld fall into three groups: first, knowledge directly related to the computer such as its workings, the software packages, maintenance, navigation and manipulation; second, generic skills such as typing, grammar and numeracy, whose importance is highlighted by the computer; and third, affective factors such as not fearing the computer and being confident in its use. Included in this third group of skills are personal attitudes of inquisitiveness and wanting to learn. The first group of skills, knowledge directly related to the computer, is the one that is predominant, particularly amongst the managers. The dominance of specific software packages being equated with skill is reminiscent of the answers provided by the Vai and Gola tailors in Lave's (1997) research, where an apprentice's learning needs were articulated as a list of garments. Upworld had attempted to cater for these needs by providing training in basic aspects of packages such as Access and Excel, training that was directly related to its business objectives, thus exhibiting an aspect of Brown and Lauder's (1999) definition of neo-Fordism.

One point emerging from the analysis of the general discussions in the interviews reflected Livingstone's (1999) argument that adult learning and knowledge is underemployed in the workplace. One respondent commented on the under-use of computer skill at Upworld, and this was borne out by the data from the interview questions on learning. This showed high levels of personal learning and the development of expertise in, for example, the use of computers for digital photography, research and book-keeping. This expertise is not utilised at Upworld. There is therefore some illustration of skills mismatch (Haughton, 1993; Felstead *et al*, 1999) at Upworld, in the sense that computer knowledge and skills are under-used. The computer skills required by Upworld are those of basic manipulation such as data input and word processing, the use of e-mail and some use of specialist

software packages by the project engineers. The findings seem to suggest that skills such as using the Internet for research or manipulation of digital photography software are not utilised because they are not directly related to business objectives.

It was not possible to explore Aronowitz and Difazio's (1994) theory that the old hierarchies of Taylorism are reflected in computing, because this research study did not look at the IT department, as it is not on site. In the introduction I described Upworld as having a matrix structure with cross-functional teams. In the past the company's structure was a Fordist hierarchy but cultural change in the company had led to structural change, with an attendant reduction of the workforce, as fewer people are needed to manage in a cross-functional environment. There has been no radical change in the overall composition of the workforce as a direct result of new technology. In looking for Conlon's (2000) technicians, craftsmen and visionaries, I found that hierarchies remain, but now seem to be reflected in levels of engagement with computers. These levels do not necessarily correspond to the levels in the occupational structures of the factory: someone who is a manager may have little engagement with computers and know just enough to get by, and shop floor workers may have considerable interest in and engagement with computers. These hierarchies were reflected to a certain extent in the constructions of computer literacy that recognised levels or that elevated programming. This leads to the discussion of the second research question.

What do individuals think computer literacy means for them and how do they feel about the computer?'

During the questionnaire phase of the empirical study the respondents ranked a number of features of computer literacy using a Likert scale (see table 4.4 on page 80). The results of the questionnaire show that the basic operator tasks, such as using a mouse or finding standard keys, are given greater prominence than the ability to design web pages or program a computer, as the attributes of a computer literate person. The preference is more for the list of skills referred to by Johnson and Eisenberg (1996) rather than anything more complex from the definitions reviewed by Bostock and Seifert (1986). This is a view of computer literacy as functional, job-related, or a matter of technique (Archer and Costello, 1990; Kellner, 1995) and not a view of the computer as a knowledge worker's tool (Haigh, 1985). However, the overall rankings certainly give the impression of a series of levels from basic use of the mouse and keyboard to design and programming, although this idea was not articulated by the respondents in the questionnaire phase. The questionnaire results were used in the second phase of the empirical study to prompt the interview discussions. The literature review shows that it has never been easy to define computer literacy and the data from the discussions reflects this difficulty. Computer literacy was perceived by the respondents in several ways, and in this subsection I want to concentrate on three major themes that emerge from the data before discussing, briefly, themes that were absent.

The first major theme is the view of computer literacy as related to the requirements of the job: if someone has the computing skills and knowledge needed for their job then they are computer literate. This view was expressed both by managers and non-managers. This is Blake and Standish's (2000:8) modest, skill-based, visible computer literacy. Two interesting metaphors serve to extend this view. First, one respondent compared computer literacy with foreign languages using a spectrum from the non-speaker, to those who get by, to those with some facility, to complete fluency. Second, another respondent used the metaphor of

catering, comparing sandwich-making with cooking a banquet, activities that are not on a scale or spectrum, but are different jobs within the same industry. From this perspective, entering data and designing a database are not on a spectrum; they are different activities that are aspects of different jobs. The designer is therefore not more literate than the person who inputs data; both are capable of being computer literate to the standards required by their respective jobs. If computer literacy *is* job-related there are possible implications for computer learning. First, this supports theories of the situatedness of computer learning through the concept of the community of practice (Lave and Wenger, 1991). Second, it argues against the transferability of such learning across contexts, since it implies that computer skills are context-specific. However, as I shall argue in the next subsection of this chapter, the interview data shows that the community of practice may not be the best way of conceptualising the acquisition of computer skills and knowledge, not least because some respondents do transfer their computer learning across the contextual boundaries of home and work.

A second major theme from the interview discussions, and one that supplements the idea that computer literacy is job-related, is that of computer literacy having levels. The literature of literacy and computer literacy suggests several typologies involving levels: technique, empowerment, expression of needs or an indicator of democracy (Archer and Costello, 1990); functional, cultural and critical literacy (Kellner, 1995); literacy as lingering basics, new basics and elite literacies, (Lankshear, 1998); and the levels specifically suggested for computer literacy of situational, operational, principal and application (McMillan, 1996). Those respondents who referred to levels of computer literacy linked them, as mentioned earlier, to the nature of the job: there had to be levels of literacy because there were levels of occupations. There could therefore be no set standard because everyone uses computers in a different way. In my view, however, there are two, possibly conflicting, perspectives of levels of computer literacy. The first, as discussed earlier, is related to the needs of the job, where once the learner has reached the level where these needs are

satisfied, they are computer literate and stop. The second is a view of levels of achievement where, as the learner ascends, they increase their knowledge and/or learn more packages and continue to increase their expertise. This may be for reasons not directly related to their work tasks. These perspectives have implications for learning because the first can be catered for by formal, job-related training but the latter probably will not be. If computer literacy *can* be defined by levels, reflecting the 1990s definitions that revolved around competencies (Hess, 1994), then it will be easier for facilitators to provide courses relevant to each level. At an early stage, Banks (1983) had argued for improved provision for adult learners in the form of computer awareness courses and more advanced post-awareness courses, but, as the next subsection will suggest, anything beyond basic awareness may now need to take the form of something other than formal courses.

A third major theme from the interview discussions of computer literacy was that of the importance of affective factors. While the majority of respondents had a positive or neutral attitude towards working with the computer, they used a number of affective terms such as *comfortable, struggle, fear factor, confident, trouble, shock to the system, nervous, mad keen* and *pressure* in describing their feelings and their computer learning experiences; not all of these are positive terms. I extended the second research question about computer literacy to include feelings about the computer as a result of the literature review, and in my analysis, I became interested in the words that people were using to express their feelings. However, as I indicated in chapter five, any further exploration of this area would involve discourse analysis, something that I have suggested in the final chapter. The inclusion of affective factors reflects the 1980s constructions of computer literacy (Bostock and Seifert, 1986) rather than those of the 1990s (Hess, 1994), referred to in chapter two. Affective factors were important to the respondents who mentioned them, but the training that the respondents had experienced had not addressed these factors, nor are they addressed in the current CLAIT syllabus, (OCR, 1998). This suggests that if people want to feel unafraid, comfortable and confident in their use of

the computer, other learning strategies, discussed in the next subsection, are preferable.

Finally in this subsection, I want to mention briefly some themes that I did not find emerging from the analysis. There was no indication that computer illiteracy was perceived as a problem in the way that print illiteracy may be (Mace, 1992). I did not find that managers admitted to having problems that they could not solve; there was no expression of any sense of the personal shame referred to by Limage (1993). Computer literacy was not a delineator of the educated, status-endowed person at Upworld, nor did attitudes to the computer, which I had initially categorised as positive, neutral or negative, necessarily equate to any particular view of computer literacy. Also, I found little mention of the new literacies discussed in chapter two, (Tuman, 1992; New London Group, 1996; Carbo, 1997), although information literacy was certainly reflected in the widespread use of the Internet, particularly in the home. However, this was not articulated as a form of computer literacy by the respondents. According to one respondent, computer literacy was related to time, in the sense that changing technical standards meant that the user was learning all the time in order to keep up with these standards. From this perspective, computer literacy might function as a metaphor for lifelong learning and/or for the world of work, thus linking the two, but the more modest, skills-based view of computer literacy (Blake and Standish, 2000) was predominant.

Almost 20 years ago, Bostock and Seifert (1984) were able to define computer literacy, tentatively, as including the understanding of the functions of a computer and its technical language, physical and cognitive skill and a grasp of the social issues relating to new technology. Their suggestions were for the incorporation of the computer into the mainstream of the tradition of liberal adult education, where it would be used in teaching and learning, and where non-specialist courses would help people to acquire computer literacy. We live in a different world now, where computers are more pervasive, where new models of computer learning are required. This leads to the discussion of the third research question.

How do people learn to use computers?

When analysing the data on initial learning from the interviews, I noticed that 19 respondents initially answered by talking about *when* or *where* they learnt rather than *how*. The context of learning is, therefore, significant from the outset. In structuring the discussion in this subsection I have used aspects of the idea of the learning career, used by Hodkinson and Bloomer (2000) to look at longitudinal patterns of learning. Their research focused on young people in sixth-form colleges and was published too late to inform the way in which I collected and analysed my data. Although my research methods did not enable me to obtain the rich and longitudinal data needed to reflect their approach, the ideas and the terminology of their paper seemed significant, especially that of the learning career. This provides a useful framework for the present discussion because first, it involves a longitudinal dimension; second, it incorporates both formal and informal learning; and third, it provides an opportunity for thinking about how learning at work might be supported.

The longitudinal dimension

The many individual stories, told by the respondents, of learning episodes with trainers, colleagues and computer manuals, gave me the idea of looking at how the respondents had acquired their computer skills and knowledge in terms of personal patterns of learning, or learning life histories. This was particularly appropriate in view of the complexity that arose from the use of different learning strategies. Various learning life histories emerged from the data. For example, ten respondents were initially shown how to use a computer by a colleague and then had to build on that with other forms of learning, while 13 began to learn at school and/or home and then used self-directed strategies for learning, reminiscent of those described by Tough (1979). Three respondents were taught about computers formally at school or university, then undertook some specialist training and currently use self-directed strategies. The only consistent pattern that emerged was that those who began their computer learning by educating themselves continued to learn in this way, perhaps having some inhouse training. No one that I interviewed was currently engaging with any formal model of education or

training, apart from the occasional use of external training providers for engineering-related software.

Some respondents' computer learning could be classified as exploratory or purposeful, while that of others was reactive. Examples of proactive and reactive histories were given in chapter five. The role that the different attitudes to computers played in these learning histories can be illustrated using three examples. The first example is Int5, a production manager, who is young enough to have had his first learning experience of computers formally at school. He has learnt subsequently in a proactive way by reading manuals and consulting colleagues but is not entirely enthusiastic about using computers, as he feels that they cut him off from his colleagues. However, he is mentioned by other respondents as a perceived expert and his neutral attitude to the computer is shared by the other perceived experts. The second example, Int23, is a production worker, who is a computer enthusiast whose initial learning was purposeful and self-directed. He bought a personal computer several years ago and taught himself to use it by reading the accompanying manual. He will now consult more expert colleagues if he needs to, and he expressed a desire to work with computers all the time. He is a proactive learner whose strategies have brought him to a stage where he is very positive about his work with the computer. The third example, Int29, is someone who presents as a reactive learner. He is a production worker, with no formal education or training in the use of computers. He has learnt what he needs almost entirely from '*...picking things up...*' or by observing others at Upworld, thus exemplifying Brown and Duguid's (1992:1) '...stolen knowledge...' acquired by watching, listening and practising. This respondent describes himself as '*...getting by...*' and regards the computer as a tool and a burden. He is someone who could be said to be on the periphery of participation (Lave and Wenger, 1991) but his view of the computer will take him no further in. However, other respondents used similar strategies to Int29 yet had more positive views.

I found no substantial differences in the learning histories of managers and non-managers. For some, their computer learning is part of their personal growth, regardless of their job or status, while for others it is something required by their job.

Formal and informal learning at Upworld

The life histories discussed above incorporate aspects of both formal and informal learning, and, in terms of current learning, there is considerable evidence in the findings of informal learning strategies in use at Upworld. My review of the literature of informal learning saw it as concerned *inter alia* with definition of the term, the processes involved and recognition of the phenomenon. In terms of definition, these strategies can be contrasted with formal training. Two respondents had recent experience of formal external training provided by private firms in specialist engineering software, AutoCAD. Formal training in respect of more general aspects of computer use including e-mail, word processing, spreadsheets and databases, had been provided at Upworld in the form of an external trainer who ran courses on the company's premises during 1997-8. Evaluation of the effectiveness of training is acknowledged in the literature of HRM as difficult (Torrington and Hall, 1998). It requires needs analyses related to business objectives (Bright and Parkin, 1997). The computer training provided at Upworld was directly related to business objectives, and the analysis showed that respondents had reservations about its effectiveness. There was a preference for less formal strategies for learning computer skills.

At Upworld, the predominant *process* of informal computer learning was that of personal learning from friends and colleagues by talking to them. In other words, it was learning that was socially situated. Some respondents, however, had either begun or continued their computer learning proactively by working through manuals, using trial and error to solve problems or exploring computers at home, perhaps prompted by their children. One respondent began his computer learning in a way reminiscent of the respondent in the research of Fevre *et al* (2000:67) who learnt to operate a

coal cutting machine: he was presented with a manual and had to learn from that. These are not necessarily examples of self-direction in Tough's (1979) sense of the self-planned project, which reduces connections between people and works against socially situated theories of learning, but they are interesting contrasts to the more socially situated strategy of talking to friends and colleagues.

Although the most significant process at Upworld was the socially situated learning of computer skills, its nature does not quite reflect the model originally proposed by Lave and Wenger (1991). Although there was recognition amongst the respondents that some people were sources of knowledge, having mastered aspects of the software or hardware, this does not support the picture of a community of practice at the social-anthropological level. Lave and Wenger's (1991) communities are natural, culturally-constructed with either a common occupation or orientation (Ball, 2003). At Upworld, there was no common occupation or orientation, except in the sense that everyone was engaged, directly or indirectly, in bringing the same product to the market. The situation seems too multi-layered to be a community of practice but my analysis led me to revisit the model proposed by Wenger *et al* (2002). This is mentioned in the literature review (page 43), but I now want to return to it in more detail as a result of my analysis. In their operationalisation of situated learning theory, Wenger *et al* (2002) say that one of principles for the cultivation of communities of practice within an organisation is that of inviting different levels of participation. Their detailed account is summarised in a diagram of concentric circles, shown in fig. 6.1, containing a core group and its coordinator, an active group, a peripheral group and the outsiders.

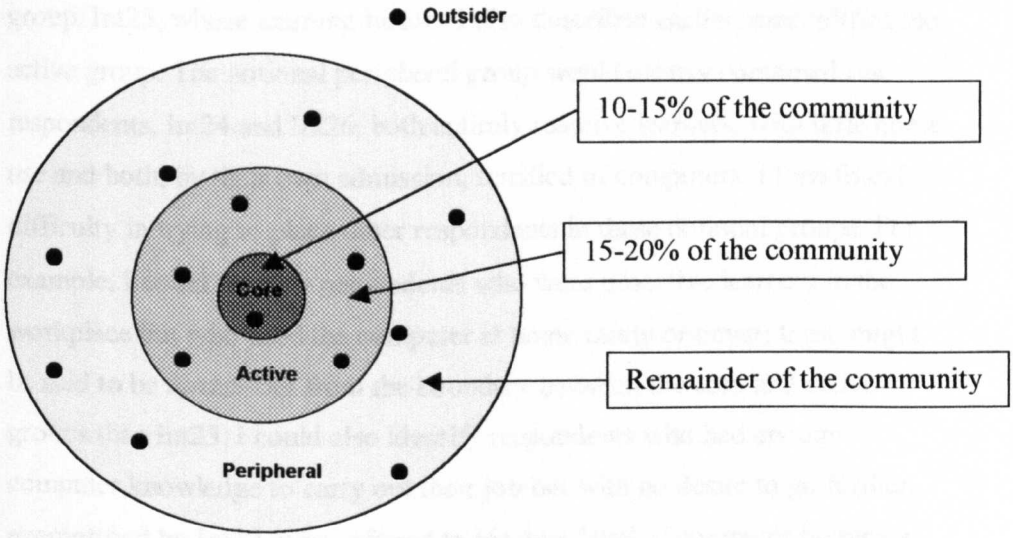

Fig.6.1 Diagram adapted from Wenger *et al,* (2002:57).

The core group is at the heart of the community. The active group consists of members who participate but without the core group's intensity. The peripheral group members rarely participate but watch the interactions of the core and active groups. Outsiders are defined as those with an interest in the community, such as suppliers and customers (Wenger *et al*, 2002:56). This is a more developed description than that of Lave and Wenger's (1991) original notion of the community of practice and those on its periphery, and I found that it was partially reflected at Upworld. Using Lofland and Lofland's (1984) idea of roles as a thinking unit in analysis, I found that there were mentions in the interviews of the roles of *expert*, *specialist* and *master*, the latter echoing the master/apprentice model of Lave and Wenger (1991). The notional core group at Upworld contained five respondents, all managers, who were referred to by others as experts, masters or as people whom they consulted. None of these five are in any way IT professionals. Int5, whose learning history I described earlier on page 139, exemplifies the core group. The notional active and peripheral groups were less recognisable.

The notional active group might consist of proactive learners, who were knowledgeable and confident using the computer at home and positive about their computer learning, but who did not seem to be part of the core

group. Int23, whose learning history I also described earlier, exemplifies the active group. The notional peripheral group would clearly contained two respondents, Int24 and Int26, both entirely reactive learners, with little home use and both, by their own admission, terrified of computers. I then found difficulty in trying to place other respondents in these notional groups. For example, I could identify respondents who were proactive learners in the workplace but who used the computer at home rarely or never; these might be said to be further out from the boundary between the core and active groups than Int23. I could also identify respondents who had enough computer knowledge to carry out their job but with no desire to go further, exemplified by Int29, who referred to his own level of computer literacy as '*...picking round the edges...*'. He could be said to be nearer to the boundary of the active and peripheral groups than either Int24 or Int26.

I looked again at the notional core group and found that of the five acknowledged experts, I was unsure whether two, Int12 and Int21, were really sharing their knowledge in the same way as the others, who were actively engaged in developing a database for production. Similarly, in the active group I could place some respondents further out from the core group than others. Some active learners seemed to stop when they had enough; perhaps they are on the edge of those less enthusiastic. Some respondents enhance their computer skills because of intrinsic interest in the computer as a machine, some use the computer as a vehicle for improvement in their home lives and some go no further than they need to for their work tasks. It seemed that the boundaries of the circles in Wenger *et al*'s (2002) model were more fluid that their diagram suggests, perhaps more of a continuum from the centre outwards. It was becoming clear to me that, although the overall situation might be partially described using a version of Wenger *et al's* (2002) model, this still did not quite capture the process of informal learning at Upworld, nor were the pedagogic practices those of the earlier, culturally situated model of Lave and Wenger (1991). Learning can be conceptually situated at one of three levels (Mayes, 2002): the social-anthropological level; the level of the learning group, where learning itself is the practice; or the level of individual relationships. I would argue that it

is at this third level that the respondents' computer learning at Upworld is situated. This provides an alternative way of viewing the community of practice as one in which those further out from the notional centre learn from those further in.

Mayes' (2002) third level of situatedness is exemplified by the data from the respondent diary. The analysis of this data shows that requests for help from the respondent were varied in nature, ranging from basic problems such as entering the wrong date or not being able to find a saved file, to sophisticated enquiries about the design of forms and subforms in a database. In looking at the pedagogic practices implicit in the diary, I saw that they were similar to those found by Fuller and Unwin (2002) in their research on the steel industry: showing how, explaining, giving information, working with. However, I needed to make one addition that I shall call *fixing for*. In a subsequent conversation with the respondent who kept the diary, he commented that:

> '*...very few people are interested in extending their knowledge. The vast majority want a quick fix way out, but are not interested in remembering it. Also, most people are quite happy for me to do the job, to give me the computer and tell me to do it. They don't say 'Tell me and I will learn'- that's what I would do...*'

This does not suggest an active community of practice but is perhaps more like Wenger *et al*'s (2002) developed analysis of the organisational community, where the majority are in the peripheral group and rarely participate. The diary respondent was, however, flattered to be consulted by colleagues and enjoyed finding solutions in cases where he could not solve the problem immediately. In the diary he frequently uses phrases such as '*...I had seen similar problems before...*' or '*...I remembered a similar problem...*' but none of his expertise is captured by management in any way. The diarist respondent was clearly providing help in context, a feature of communities of practice identified by Evans and Rainbird (2002:17), unlike the out-of-context knowledge provided by training. His role is that of the more skilled or knowledgeable person, which suggests that aspects of

apprenticeship or mentoring might be considered as alternative models to that of the community of practice for the informal learning practices at Upworld.

Traditional apprenticeship may not, however, be sufficient as a model for two reasons. First, it has a sense of progression through time, which accords with the idea of the learning career discussed earlier, but the acquisition of computer literacy, not in itself an occupation but an underpinning skill, may not fit the traditional, time-centred model. Second, apprenticeship is more formally structured than the informal consultations reflected in the respondent diary and the interviews, for which mentoring might be an alternative model. Garvey (1999) found mentoring to be widespread in the manufacturing, public and service sectors, where it is associated with developing and facilitating change and where its most common form is an informal, natural approach. This informality is certainly indicative of the computer learning situations at Upworld, yet mentoring, like traditional apprenticeship, may not be a sufficient alternative to the community of practice. Certain aspects of the role of the mentor, as described by Roberts (2000:151), could be applied to what the respondent diarist and similar perceived experts were doing: there was the essential mentoring attribute of a process of consultation, an active relationship between the respondent and those who consulted him, and some indications of teaching, learning, and reflective practice. However, those aspects of Garvey, Alred and Smith's (1996:10) description of mentoring as a holistic and significant personal relationship are absent from the episodes described in the diary and from the learning episodes described by the respondents in the interviews. Also, the process was neither formalised nor related to career development (Roberts 2000:151). People at Upworld who are, like the diarist, perceived as experts, may experience some of the conditions that enhance their ability to talk about their knowledge: a mediating object such as a problem, regular mutual consultation such as the working group on the database and a crisis, review, or change in practice (Eraut, 2000). What is missing is any formal acknowledgement by management that these people are in a training or mentoring relationship. Insofar as there is a computer learning process going

on at Upworld, it is not an environment for informal learning that has been consciously facilitated by the company. This leads to the third aspect of the learning career: support for learning at work.

Supporting learning at work

The workplace is an increasingly important site for learning (Evans and Rainbird, 2002) yet attempts to operationalise workplace learning theory often seem to be ideal rather than realistic. One example of such an ideal is the learning organisation (Senge, 1990; Pedlar *et al*, 1991). One problem with the idea of the learning organisation identified from the literature is that it seems to be applicable only to large corporate organisations, and while Upworld may be such an organisation when considered from a worldwide perspective, the site of the research study is a small factory, where there was no evidence of any attempt to capture the computer learning that was taking place. Provision for computer learning at Upworld since the mid 1990s was in the form of introductory training courses related to its business objectives but there was no provision for dealing with the solution of day-to-day problems or for encouraging further computer learning. Also, I did not find any indication that Senge's (1990) disciplines of personal mastery, mental models and team learning were being espoused: the only respondents who went beyond skill in a creative way (personal mastery) were those members of the notional core group; the mental models of computers revolved around constructing it as a tool; and computer learning occurred to some extent in a social context but not in a team context. Both Senge (1991) and Wenger *et al* (2002) believe that learning can be managed but my conclusion was that there was no attempt to do this with the computer learning at Upworld.

One way that individuals can be helped to become more capable learners is for their managers to take more responsibility for facilitating learning (Eraut *et al*, 1999) but this was not a feature of the situation at Upworld. In this study, what has shaped the informal learning has proved to be more significant than any management support structures. Part of the computer learning process is dependent on a number of people who exemplify those

who have made a career of informal learning, referred to as learning entrepreneurs by Coffield (2000:8): they learn in the workplace, in this case Upworld, because they learn everywhere else (Fevre *et al*, 2000). This leads to the discussion of the final research question.

Is the learning transferred between home and work or are there boundaries?

A further aspect of the question of how people learn to use computers is the extent to which this learning might transfer between work and home, and vice versa. The concept of the workplace as a site for computer learning implies that this learning may spill over into leisure, because computers have uses both at work and at home. At Upworld the boundary between work and leisure became less than distinct when, in 1993/4, some members of the production staff were provided with computers to use at home. At the time, computers were in the process of being introduced onto the production line and it was felt by management that the production staff would benefit from this familiarisation. It seems that Upworld recognised that the personal computer was something that was becoming all pervasive, something whose use could not be taught in single training sessions. The analysis of the interview data supported the view that computer skills may be learnt in the context of the workplace but that many respondents continue this learning at home and vice versa.

Among the 25 respondents who used a computer at home, either regularly or occasionally, there was considerable use of the computer that had nothing to do with work tasks, for example, use for preparing household accounts, looking for holiday bargains or playing games. There were also expressions of desire to learn new aspects of computer use. Although some of these desires related to work usage, for example, networks, touch typing, formatting and particular software packages, some did not: digital photography and image manipulation, building a website, programming and using the Internet to trace friends. This personal learning and usage of computers at home seems to undermine any simplistic view that computer

literacy is related only to the needs of the job. However, some respondents did not want to use a computer at home. For example, a senior manager said '*...not if I can help it...*' when asked if she used a computer at home; others, both in managerial and non-managerial roles, equated the computer with work, so rarely used one at home or only did so if they had work to do.

To talk of a boundary can be to talk positively of keeping something in, with connotations of protection or preservation, or negatively of keeping something out, with connotations of exclusion or limitation. Wenger *et al* (2002) talk of the fluidity of community boundaries and, as discussed in the previous subsection, there was considerable fluidity within the notional groups at Upworld when I tried to apply Wenger *et al*'s (2002) model of the community of practice. The data suggest that computer learning is an important example of where the boundary between home and work life becomes more permeable, more fluid (Boud and Garrick, 1999), for some but not all of the respondents.

Summary

This chapter has presented a discussion of the issues arising from the analysis of the data collected during this research study. The discussion was framed around the four research questions.

Computer technology has affected individuals at Upworld by bringing about change, more so for those with more complex jobs. The data showed that managers tend to use a wider variety of computer applications than non-managers; no one at Upworld has become a symbolic analyst or knowledge worker, (Reich, 1992). Computers have brought changes, in particular to communication, but the computer was seen more as an alternative device for communication than a better tool. The ubiquitous nature of personal computers at Upworld means that people need the skills and knowledge to be able to use them. These skills were perceived by the respondents predominantly as directly related to the computer and its workings, but generic skills and affective factors were also mentioned. However, the level

of computer skills required at Upworld is below that held by some of the respondents, illustrating Livingstone's (1999) argument that adult learning and knowledge is underemployed in the workplace. The findings suggest that Upworld requires and utilises only those computer skills that are directly related to its to business objectives. The older hierarchies of Taylorism are perhaps reflected in the different levels of engagement with computers, but these do not correspond to the levels of the occupational structure at Upworld. This idea of hierarchies is reflected in one of the constructions of computer literacy.

Computer literacy is not easily defined. However, three major themes arose from the data. The first theme was that computer literacy was related to the needs of the job: someone was computer literate if they had computer skills and knowledge needed to do their job. The second theme was that computer literacy had levels. The idea of levels has a two-fold perspective: either the learner reaches the level they need then stops, because they are computer literate, or the learner carries on ascending through levels, increasing their knowledge. The former can be catered for by training and formal learning, the latter requires other forms of learning. The third theme was that of affective factors being important in a definition of computer literacy: people at Upworld wanted to feel comfortable with the computer and unafraid of it. This was reminiscent of very early definitions of computer literacy reviewed by Bostock and Seifert (1986). The data provided little mention of the new literacies, but information literacy was apparent in the widespread use of the Internet. There were predominantly positive or neutral views of the computer as a tool, but these did not correspond to particular views of computer literacy. Constructions of computer literacy have implications for learning: the view of computer literacy as job-related would support a theory of the situatedness of computer learning through a community of practice (Lave and Wenger, 1991).

Using the device of the learning career, I looked at the longitudinal dimension of computer learning, informal computer learning and support for computer learning at Upworld. There is complexity in the computer learning

strategies adopted by the respondents: some are autonomous learners, prepared to work things out for themselves, while others are dependent on people whom they perceive as experts. I found from the respondents' computer learning life histories that they could be regarded as proactive or reactive learners and gave examples. Informal computer learning strategies were preferred to training at Upworld, and the predominant process was of talking to colleagues. The data suggest that a transmission model of computer learning is of value at the very earliest stages, or, by contrast, at much later stages where the learner needs to develop their expertise in a particular application. For everything else, a different model may be preferable. Wenger *et al*'s (2002) revised model of the community of practice did not quite capture the process at Upworld; it may be that computer learning is situated at the level of individual relationships rather than any social-anthropological level (Mayes, 2000). This situatedness, which is closer to a model of mentoring than to apprenticeship, is current at Upworld but is not formally supported in any way.

The analysis of the data shows that there is considerable transfer of computer learning between home and work, and vice versa, such that many people's computer ability is under-used at Upworld. For many respondents, the boundary between home and work life is less than fixed when considered from the perspective of computer use. The levels of personal learning and the usage of computers at home seem to undermine any simplistic view that computer literacy is related only to the needs of the job

The final chapter of the dissertation summarises the conclusions from this discussion and presents a number of recommendations and assessments, including my own review of the research study.

Chapter 7 Conclusions

Introduction

This final chapter of the dissertation begins with a summary of the conclusions from the research study. This is followed by a justification of the originality of the research, a note of its relevance for education practitioners and suggestions for further research. Finally, I have presented my own evaluation of the work that I have done.

Summary of conclusions

This research study has explored two key themes of computer literacy and learning against a broader context of the changing nature of work under the impact of computer technology. Focusing on a single manufacturing company, the following questions were asked:

1. How has computer technology affected individuals in the workplace in terms of work itself and the way they work?
2. What do individuals think computer literacy means for them and how do they feel about the computer?
3. How do people learn to use computers?
4. Is their learning transferred in any way between home and work or, if there are boundaries, what is their nature?

From an analysis of the descriptive data, collected by means of a questionnaire, semi-structured interviews and a respondent diary, I now argue that these questions can be answered as follows.

1. The personal computer has become a ubiquitous feature of, and has had an impact on, the day-to-day working lives of the people at Upworld. There have been changes, particularly to the way that the respondents communicate, but they have not become Reich's (1992) symbolic analysts. They do, however, need new skills in order to be

able to use computers. This has meant that some, but not all, respondents have engaged with high levels of personal learning. This has enabled them to acquire computer skills and knowledge that are not necessarily required in their workplace.

2. Computer literacy is not easily defined but in this research study there were strong perceptions of it as related to the needs of the job: if someone has the computer skills and knowledge at the level needed for their job, then they are computer literate. This would support views of computer learning as situated in a work context but would, consequently, argue against the transferability of such skills. Another perception was that of computer literacy as having levels. Affective factors were also mentioned, in that the computer literate person was someone who was comfortable with and unafraid of the computer. There were predominantly positive or neutral views of the computer as a tool, but these did not correspond to particular views of computer literacy.

3. The respondents used a number of strategies in order to acquire their computer knowledge and skills. Their learning life histories show that some are proactive and some reactive learners. These histories incorporate both formal and informal strategies but there was a preference for the informal strategies. In many cases, the respondents have more computer skills and knowledge than they need in their workplace. Theories of situated learning that are based on a community of practice seem to challenge the view that knowledge and skills are transferable across contexts, but the data from this research study suggest that in the case of computer knowledge and skills, there is an exception to be made if the learning is situated at the level of the individual relationship. The pedagogic practices at Upworld were situated, not at the level of the social-anthropological community of practice described by Lave and Wenger (1991), but at the level of individual relationships referred to by Mayes (2000) and suggest that a form of mentoring may be a

better model for the informal learning of computer skills and knowledge.

4. There was considerable transfer of computer learning between work and home, and vice versa. Most respondents had access to a computer at home and used it for a variety of activities, including work, but also including leisure activities that required skills and knowledge not acquired or needed in the workplace. Although some people wanted to preserve the boundary between work and home, expressing no desire to learn new computer skills, the predominant situation was of computer skills and knowledge transferred across the boundary of work and home and reapplied to new tasks. This provides a counterpoint to any view of computer literacy as job-related and of computer learning as situated in a community of practice at a social-anthropological level.

The implications of taking a situated perspective on computer learning are first, that it may suggest that the relevant skills and knowledge are not transferable, but the data from the research study shows that this is not so; and second, that the focus of educational provision shifts to the ways in which informal strategies might be facilitated and supported. This research study, of a multi-layered rather than a single-occupation community of practice, suggests that one such way is that of mentoring. Computer learning serves as an example of pedagogic practice crossing boundaries within the workplace, between managers and managed, and between the workplace and the home, but the issues are complex.

Originality of the study

The originality of this research study lies in the contribution that it makes to the growing debate concerning theoretical understandings of the pedagogical processes of learning in the workplace, including informal and situated learning, by focusing on the example of computers. Despite the widespread adoption of the computer into the workplace and the policy rhetoric concerning the need for the UK workforce to increase its skill level, with particular regard to IT, there remains a problem for people who want to learn about computers: training and formal education do not cover all that they might need. Training is criticised for its timing and relevance and it cannot cover the situations where computer problems occur on a daily basis. In such a situation, the learner must either ask for help or try to solve the problem alone, that is, they must learn informally.

In the informal learning debate there are different emphases, (Garrick, 1998:133): for example, Tough (1979) is concerned with the voluntary and purposeful nature of informal learning, while Marsick and Watkins (1990) emphasise its unintentional, unanticipated aspects. Much of the literature is either non-specific or focuses on occupational groups, (Lave and Wenger, 1991; Wenger, 1998). My approach has been to locate the practice of informal learning by direct reference to computer use, not by the *occupational* grouping of IT experts in the computing industry, but by people in a manufacturing environment who need to be able to use the computer as a tool in a variety of occupational areas. As a piece of social research, the study is repeatable rather than replicable, and it should serve to provide a framework for others to continue their thinking about informal learning in specific contexts.

Relevance for practice

Government policy rhetoric remains focused on the supply of learning opportunities, rather than on learners' demands, referring to the need to convince employers to offer training rather than employees to seek it, ((DfES, 2002:5). The implications of this study for practice generally seem to be that, in the area of computer skills, it might be better to concentrate less on formal training and education or on the accessibility of learning materials, and more on the facilitation of informal learning, perhaps through the approach of mentoring. The research was undertaken in a manufacturing environment but it has implications for firms and organisations in other sectors. For example, in my own higher education institution, I can recognise individuals who seem to occupy the role of the expert. These are individuals who, like the respondent diarist, are not computer specialists but who have become a source of expertise and help to less knowledgeable colleagues. The expert role evolves, so in the first instance there is a need for recognition of this role. Organisations need to allow time and space for this to happen.

My research found that people approach computer learning in different ways, some of which are linked to affective factors that are absent from a computer literacy syllabus such as CLAIT (OCR, 1998). Practitioners in the field of adult learning and training may need to address this, noting not only that informal learning is more amenable to some learners, but also that the nature of the current computer literacy curriculum, as exemplified by CLAIT (OCR, 1998), is task-based and functional. Some of the data in the research study suggest that a better introduction to computer use might be an introduction to the Internet in order to encourage further personal computer learning.

The research may also have value for those in the Human Computer Interaction community, where research on affective factors *is* carried out, but from a psychological perspective aimed at improving the interface between the person and the machine. This research is typically quantitative

in terms of its methodology, so the present research study might have value as a starting point for those who want to take a more qualitative approach in HCI research.

Suggestions for further research

The picture of informal learning in the context of computers that this research study provides arises from a three-year, part time study of workers in a single factory, so can yield conclusions that cannot be generalised except by using Bassey's (2001) fuzzy logic. However, I would argue that the picture generated by the study provides some useful starting points for further work in five areas.

First, one overarching theme of the analysis in this research study is that of complexity. This ranges from the multiplicity of responses to questions, to apparent contradictions within one respondent's account. It is reflected in the different ways that people approach their computer learning, using different strategies. Some of these are linked to affective factors, which I referred to in the previous subsection. Initially I had not expected to review the literature on affective factors in computer literacy but I would suggest that more research is needed into their place in the provision of computer education.

Second, there is a need to repeat the study in other sectors, such as higher education institutions and service organisations, in order to explore whether there is a similar proliferation of learning strategies amongst employees in those sectors.

Third, further research is needed into how models of informal or situated learning might be adapted and operationalised to incorporate relevant aspects of alternative models, such as apprenticeship and mentoring, and support them in the workplace.

Fourth, the study was carried out part time, which necessarily constrained the methodological approach. Seeking an understanding of personal perceptions through the medium of interviews, for example, is likely to foster a generalised response, but I could not adopt a more ethnographic approach because the research was part time and not in my own workplace. A more ethnographic piece of research might prove useful in enabling the researcher to observe, as a participant, the application of computer learning in the workplace.

My final suggestion is that further research is needed into self-direction as a strategy for learning to use computers. Some of the respondents had learnt autodidactically, but much of the seminal research in this area (Knowles, 1975; Tough, 1979) was carried out before the advent of the personal computer. There might be value in looking at personal computer learning constructed as a self-planned project.

Evaluation of the study

It is probably a truism that no researcher is ever fully satisfied with their efforts and this is certainly true of my feelings about the present study. I would present three broad criticisms of, or areas of dissatisfaction with, what I have done, all, of course, with the benefit of hindsight. First, opportunities were missed. For example, in my selection of respondents to interview I had chosen a female engineer but she left Upworld before I began the round of interviews. This was a little disappointing, as she would have helped to balance the gender split in the sample of respondents. Second, the research instruments provided too much data. Interviews are not easy to control if they are anything other than verbal questionnaires; some of the conversations that I had with the people from Upworld meandered, and I let them meander because people were telling me interesting stories, but I have not been able to use all these stories in my analysis. Third, time was wasted pursuing tangential ideas. For example, I became fascinated with analysing people's comments about e-mail and the way that it affected

communication, a major change brought about by computers but not really the core of my research.

As a postscript almost, I want to present some personal reflections on the role of the computer in this research study about the computer. In producing this dissertation, I have used a computer to perform a number of tasks: literature searching on the Internet; typing up transcripts of interviews; recording, filing, indexing, coding and retrieving data; analysing the questionnaire data and producing graphs; and editing and spell-checking the text. I have been able to structure and restructure the text of this dissertation with ease, including writing it non-sequentially. I have used e-mail and a virtual learning environment in order to communicate with my supervisor. I could have gone further and used one of the software programs now available for analysing data, although I rejected this course of action because I did not want to take a mechanistic approach to my analysis. I have been pleased with the reflexive nature of the study in the sense that my exploration of the influence of the computer, and of how people learn to use it, has contributed to my own learning and has sharpened my awareness of the computer's contribution to the production of this text.

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Appendix A

A1: Pilot version of the questionnaire

Computer literacy in the workplace: Questionnaire

Question 1

I am interested in what you think someone should know, or be able to do, in order to be called 'computer literate'. In the table below are some computing tasks or areas of knowledge. Please tell me, *by ticking in the relevant column*, how important each one is to your definition of the 'computer literate' person.

	Essential to my definition	Very important	Useful but not very important	Not important	Can't decide
Use a mouse, e.g. to scroll up or down in Windows					
Use a word processing application to write a letter or compile a 1-page report.					
Manage files on a personal computer by using the directory structure, deleting unwanted files etc.					
Find standard keys such as <backspace> or <shift> on the keyboard					
Enter data into a spreadsheet application such as Excel					
Enter data into a database using screen layouts designed by someone else					
Install a new piece of software on a personal computer.					
Apply designs, e.g. columns, different fonts, to a word-processed document					
Design a database					
Identify the cause of problems when things are going wrong with a personal computer					
Design a spreadsheet containing complex formulae					
Write and send email messages					

	Essential to my definition	Very important	Useful but not very important	Not important	Can't decide
Know how to connect up the keyboard, monitor, mouse etc. of a personal computer and get it to work					
Obtain information from the World Wide Web/Internet.					
Attach a file to an email message					
Explain the function of the different parts of a personal computer e.g. the processor, disk drives etc.					
Design a web page.					
Write Visual Basic programming code.					

Question 2

Is there anything else, missing from the above list, which you think indicates a computer literate person? (*If so, please write it in the space below)*

Question 3

Which of the following computer applications do you use at work? (*Please tick one option for each item you use to indicate how often you use it)*

	Use daily	Use at least weekly but not every day	Use less than once a week	Never Use
Word processor e.g. Word				
Desktop publishing or presentation software e.g. PowerPoint				
Spreadsheet e.g. Excel				
Database e.g. Access (to input or retrieve data)				
Computer controlled production equipment				
email				
Internet/World Wide Web				

Finally...

In order to help me to analyse your replies, please give me the following details about yourself:

Your first name and surname:

Your age group (*please tick as appropriate*) : Over 50
35-50
under 35

What is your job?

Please list any qualifications in any aspect of Information Technology or computing that you have.

Thank you

Thank you very much for your co-operation in completing this questionnaire. Please send it in the enclosed envelope, via internal mail, to the Personnel Department by Friday 19th January 2001.

A2: Final version of the questionnaire

Computer literacy questionnaire

Question 1

I am interested in what you think someone should know, or be able to do, in order to be called 'computer literate'.

In the table below are some computing tasks or areas of knowledge. Please tell me, *by ticking in the relevant column*, how important each one is to your definition of the 'computer literate' person.

	Essential to my definition	Very important	Useful but not very important	Not important	Can't decide
Use a mouse, e.g. to scroll up or down in Windows					
Use a word processing application to write a letter or compile a 1-page report.					
Manage files on a personal computer by using the directory structure, deleting unwanted files etc.					
Find standard keys such as <backspace> or <shift> on the keyboard					
Enter data into a spreadsheet application such as Excel					
Enter data into a database using screen layouts designed by someone else					
Install a new piece of software on a personal computer.					
Apply designs, e.g. columns, different fonts, to a word-processed document					
Design a database					
Identify the cause of problems when things are going wrong with a personal computer					
Design a spreadsheet containing complex formulae					
Write and send email messages					

	Essential to my definition	Very important	Useful but not very important	Not important	Can't decide
Know how to connect up the keyboard, monitor, mouse etc. of a personal computer and get it to work					
Obtain information from the World Wide Web/Internet.					
Attach a file to an email message					
Explain the function of the different parts of a personal computer e.g. the processor, disk drives etc.					
Design a web page.					
Write Visual Basic programming code.					

Question 2

Is there anything else, missing from the above list, which you think indicates a computer literate person?

(*If so, please write it in the space below*)

Question 3

Which of the following computer applications do you use at work?

(*Please tick one option for each item you use to indicate how often you use it*)

	Use daily	Use at least weekly but not every day	Use less than once a week	Never Use
Word processor e.g. Word				
Desktop publishing or presentation software e.g. PowerPoint				
Spreadsheet e.g. Excel				
Database e.g. Access (to input or retrieve data)				
Computer controlled production equipment				
email				
Internet/World Wide Web				

Finally...

In order to help me to analyse your replies, please give me the following details about yourself:

Your first name and surname:

Your age group (*please tick as appropriate)* : Over 50
35-50
under 35

What is your job?

Please list any qualifications in any aspect of Information Technology or computing that you have.

Thank you

Thank you very much for your co-operation in completing this questionnaire. Please send it in the enclosed envelope, via internal mail, to the Personnel Department by Friday 19th January 2001, or as soon as your shift pattern allows.

A3: Covering letter

8th January 2001

Computer literacy research

Dear [*Upworld*] employee,

I am writing to ask for your help in a piece of research that I am doing in connection with my work for an Open University degree. I am looking at what 'computer literacy' means to people in the workplace. This is a topic of interest to all of us nowadays, as we are continually told that we need to have computer skills to help us in our work and in our leisure time.

I have obtained permission from the plant manager to carry out this research. I would like you to complete the attached questionnaire, which should take you about 10 minutes. The results, when analysed, will give me a general picture of what the people at [*Upworld*] use computers for, and what they think about computer literacy.

Any information that you give me will remain confidential. The analysis of your replies will form part of the thesis that I produce, but no one else will see the returned questionnaires, and it will not be possible to identify individual replies when they are summarised for the thesis. I have asked for your name so that I can follow up some of the questionnaires with voluntary interviews later in the year.

Please complete the questionnaire, place it in the enclosed envelope and send it via the internal mail to the Personnel Department by Friday 19th January 2001, or as soon as your shift pattern allows. I will collect it from there.

Thank you for taking the time to read this letter and complete the questionnaire. If you have any queries about it, please ring me during working hours on 0191 5153161

Yours sincerely,

Jean Barnett.

A4 Extract from spreadsheet of questionnaire results

	Questionnaire - Basic Data from Returned Forms								
Q.Ref	11	12	13	14	15	16	17	18	19
A1	4	3	3	4	3	4	2	2	2
A3	4	3	3	4	3	4	2	2	0
A5	4	1	1	1	2	2	1	1	1
A6	4	3	2	4	4	4	1	1	1
A11	4	1	2	2	0	4	1	1	1
A13	4	3	3	4	3	3	3	3	2
A14	4	2	0	2	4	3	4	2	3
A15	4	3	3	3	3	4	3	3	3
A17	3	3	2	3	3	2	2	3	4

Q.Ref	110	111	112	113	114	115	116	117	118
A1	2	2	3	2	3	4	2	2	2
A3	4	2	3	3	1	2	0	0	1
A5	2	1	1	1	1	1	1	1	1
A6	2	2	4	2	2	3	1	1	1
A11	3	1	1	1	1	1	1	1	1
A13	2	2	3	3	3	3	3	2	2
A14	3	4	2	3	3	2	3	2	3
A15	4	2	3	3	2	3	2	2	3
A17	3	2	4	3	3	4	3	2	0

Q.Ref	2	31	32	33	34	35	36	37	M/F	O/M/Y	Job	Quals
A1		D	L	L	D	D	L	N	M	M	Tech. co-ordinator	
A3		L	N	N	D	D	N	N	M	O	PO	
A5		N	N	L	W	D	N	N	M	M	PO	
A6		D	N	D	D	D	D	N	M	O	Tech. co-ordinator	Basic
A11		N	N	N	D	N	N	N	M	M	PO	
A13		D	L	D	D	L	D	N	M	M	Tech. co-ordinator	Basic
A14		N	N	N	W	N	N	N	M	O	PO	
A15		N	N	N	D	D	L	N	M	M	PO	
A17		W	L	L	W	D	W	L	M	M	PO	

A5: Allocation of rankings for question 1

(Each row totals 115.)

Question number	Item descriptor	4	3	2	1	0
1.1	Use a mouse	77	25	11	1	1
1.4	Find standard keys	59	40	12	3	1
1.12	Write and send emails	33	42	28	9	3
1.6	Enter data into database	32	47	34	1	1
1.2	Use word processor: letter	31	49	29	4	2
1.3	Manage files	30	47	27	7	4
1.5	Enter data into spreadsheet	29	57	24	0	5
1.13	Connect up a PC	27	39	38	8	3
1.15	Attach a file to an email	22	42	30	12	9
1.10	Identify cause of problems	18	45	36	13	3
1.7	Install software	18	29	44	17	7
1.8	Apply designs: word-processing	15	36	43	17	4
1.9	Design: database	11	17	41	38	8
1.11	Design: spreadsheet	9	18	52	28	8
1.14	Obtain information from WWW	8	26	58	21	2
1.16	Explain parts of a PC	7	19	54	28	7
1.18	Write code	5	9	34	54	13
1.17	Design: web page	4	5	43	54	9

A6: Responses to question 2

The responses listed below are the full text of the answers to question 2:

- Can you get what you need from the computer to do your job? Then again, home use of a computer is different. [*Production operative*]
- Know how to start up/reset or close down without damaging stored data. [*Maintenance fitter*]
- Understanding of how to use 'control panel' and what this section of the computer can do. [*Production supervisor*]
- Moving between applications and transferral/copying of data. [*Electrical planner*]
- Switch a PC on. [*Process engineer*]
- Basic keyboard skills. [*Accounts assistant*]
- Comfortable to go straight to keyboard without need for paper/pen sketch/draft. [*Engineer*]
- Be able to get things printed out the way you want. [*Environment manager*]
- Anyone who can comfortably work with unfamiliar software/worksheets, i.e. can find their way around- not frightened of it. [*Financial controller*]
- Being able to apply basic computer knowledge onto new software packages/versions that come out all the time. This does not mean fully knowing all their functionalities, but enough to do what you want to do in a basic form. [*Production planning manager*]

Appendix B

B1: Interview schedule: first version

Basic details (record sheet)
Date of interview, name, job title, brief job description, age, qualifications.

Introduction
1. Introduce self and the research.
2. Mention confidentiality.
3. Ask permission to tape

1 Impact of computers at work

Questions	Prompts	Probes
1.1 What do you use a computer for in your work?	Tasks? Documents?	
1.2 How has the computer changed your work?	Easier? Harder?	Has it removed control or increased control? Has it helped/stopped you making judgements? Has it enabled you to work with others more/less?
1.3 What computer skills are essential for you to do your job?		

2 Learning

Questions	Prompts	Probes
2.1 How did you begin to learn about computers?	College? Work? Home?	Why did you learn?
2.2 How do you learn now?	Training? Ask people? Other?	Which is best for you? Why?
2.3 Are your computer skills fully used?		What skills are not being used?
2.4 How do you solve any problems that you have with the computer?	Hardware? Software? Talk to people? Use 'help facility? Other?	
2.5 What computer skills would you like to learn?	For work? For home?	How do you keep up to date with developments?

3 Computer literacy

Questions	Prompts	Probes
3.1 My earlier questionnaire showed that overall, the top five attributes were operator tasks. Does this surprise you?		Why were informational aspects so low?
3.2 Think of someone you know who is computer literate. What is it about them that makes you think of them in this way?	Abilities? Qualifications?	Would you describe yourself as computer literate?
3.3 What do you see as the benefits and disadvantages of computers?	Work? Home?	

Closure

1. Do you want to add anything that seems important that I haven't mentioned?
2. Do you want to ask anything about the research?
3. Thank you.

Post interview

Reflect on:

- How it went generally
- My relationship with them
- Any problems, interruptions etc.
- The ambience
- Information given after tape switched off.

B2: Interview schedule- final version

Basic details

Note down on separate record sheet date of interview, name, job title, and age group. (These are on questionnaire.)

Introduction

1. Introduce self and the research.
2. Mention confidentiality.
3. Ask permission to tape the interview
4. Ask for a brief job description and confirm IT qualifications (or lack thereof) and educational background.

1 Impact of computers at work

Questions	Prompts	Probe
1.1 What do you use a computer for in your work?	Tasks? Documents? Data? Communication? Internet?	Communications- who? Why? Data analysis- Access? Excel? Purpose?
1.2 How has the computer changed your work?	Say, last 2 years. Work itself? Way you work? Easier? Harder?	Changes to the way they communicate at work Removed/increased control of job Helped/stopped them making judgements Enabling work with others more/less More/less paperwork More/less valuable information
1.3 What computer skills are essential for you to do your job?	Keyboarding? Spreadsheet analysis?	Skills that are helpful rather than essential. (Link to 1.1)

2 Learning

Questions	Prompts	Probe:
2.1 How did you begin to learn about computers?	College course? Work training? Home?	Motive for learning
2.2 How have you learnt new computer skills more recently, say within last 2 years?	Training? Asking people? Other?	Training within the last year or two Learning from/with others Others learning from you. Examples.
2.3. How do you solve any problems that you have with the computer?	Hardware? Software? Talk to people? Help facility? Other?	Types of problems People consulting you. Examples.
2.4. Do you use a computer at home? For what?	Internet? Games? Letters?	Using different skills at home. Skills they would like to learn. Solving computer problems at home
2.5 Do you like working with computers?	Comfortable? Afraid? Worried? Frustrated?	Reasons for liking/not liking. Feelings of control, fear, frustration etc. Opinions re benefits/disadvantages of computers.

3 Computer literacy

Questions	Prompts	Probe
3.1 (Refer to results of questionnaire). Does this surprise you?	Show list.	Attributes of the 'computer literate' person. Opinions re benefits/disadvantages, if not probed above.

Closure

1. Do you want to add anything that seems important that I haven't mentioned?
2. Have you any comments on the interview itself?
3. Do you want to ask anything about the research?
4. Thanks.

Post interview

Reflect on:

- How it went generally
- My relationship with participant
- Any problems, interruptions etc.
- The ambience
- Information given after tape switched off.

B3: Interview record sheet

Date of interview	
Name	
Job title	
Brief job description	
Age group	
Educational background	
IT qualifications	

B4: Respondents interviewed

Interview	Occupation	Gender	Age	Group
1	Environment manager	M	O	G
2	Engineer	M	M	F
3	Logistics manager	M	O	G
4	Administrator	F	Y	D
5	Industrial engineer	M	Y	F
6	Production supervisor	M	M	E
7	Administrator	F	Y	D
8	Plant controller	F	M	G
9	Production supervisor	M	M	E
10	Accounts administrator	F	M	D
11	Maintenance manager	M	M	F
12	Service manager	F	Y	G
13	Warehouse operative	M	Y	C
14	Production supervisor	M	O	E
15	Engineering manager	M	O	F
16	Warehouse supervisor	M	M	E
17	Technical supervisor	M	M	E
18	Production operative	M	O	A
19	Sales manager	M	M	G
20	Planner	F	M	E
21	Project engineer	M	Y	E
22	Production operative	M	Y	A
23	Production operative	M	M	A
24	Warehouse operative	M	O	C
25	Maintenance fitter	M	O	B
26	Sales administrator	F	O	D
27	Production operative	M	M	A

28	Plant manager	M	M	F
29	Production operative	M	M	A
30	Maintenance fitter	M	Y	B

B5 Anticipated data categories

Question topic	Prompts	Possible expected responses
1.1 Use of computer	Tasks, documents, analyse/input data, communicate, use Internet	Produce documents, spreadsheets, input information, send e-mails.
1.2 Change	Work itself, way you work, easier, harder	More/less paperwork, more/less control, isolation, quicker, more efficient
1.3 Skills needed	Keyboarding, analysis	Typing, ability to navigate/maintain/install software.
2.1 Initial learning	College/school, training, work, home	College/school, training course here/elsewhere, evening class, and reading manuals.
2.2 Current learning	Training, asking people, other	Training here, asking colleagues/friends, reading magazines, evening classes.
2.3 Problems	Technical, error messages, software, talking to people, help' facility, manual.	IT department, asking colleagues, using 'help' for software problems.
2.4 Home use	Internet, letters, games	Work, leisure, Internet, no home use
2.5 Attitude	Comfortable, afraid, worried, frustrated.	Positive, negative, neutral.
3 Discussion	Use list as prompt.	Levels of computer literacy, requires knowledge, qualifications.

B6: Coding dictionary

Question	Code	Meaning
1.1 Use	Comms1	Using e-mail
	Package	Specific application, e.g. MSWord
	Info	Searching for, passing on or analysing information
	Enter	Entering data of some kind
	Control1	Controlling machinery, documents, aspects of the plant
	Produce	Creating documents or loads
1.2 Change	Comms2	Effect of e-mail on communication
	Paper	Increase/decrease in paperwork
	Control2	Control over work, documents, machine etc.
	System	Effect on a system, on procedures
	Time	Saving/consuming time
	Judgement	Effect on using/suspending personal judgement
	General	Work is easier/harder
	Noeff	No change
1.3 Skills	Feelings	Confidence, lack of fear
	Applications	Ability to use Word, Excel etc.
	Typing	Using the keyboard
	Maint	Computer maintenance
	Navigate	Finding your way around Windows etc.
	Know	Background knowledge of how computer works
	Manip	Opening, saving files etc.
	Train	Training

2.1First learning	Formal	Taught formally at school, university, college
	Self-taught	Learnt autonomously and informally by personal exploration, reading manuals etc.
	Shown	Demonstration by a colleague
	Training	Received some form of workplace training
2.2 Learning now	InhouseA	Training at Upworld, usually on site, or at US headquarters or with private company
	Talking	Asking other people, colleagues, friends
	Self2	Personal learning, e.g. exploration, trial and error
	Observ	Watching others at work
	Manuals	Reading books and manuals
2.3 Problems	ITM	Asking the IT manager for help
	Ask	Asking colleagues for help
	Selfsolve	Solving problems alone
2.4 Home use	Internet	Surfing Internet, shopping etc.
	Leisure	Playing games
	Work	Doing work tasks at home
	Study	Course assignments
	House	Accounts, budgeting
2.5 Attitude	Positive	Like computers
	Neutral	Not bothered or had mixed feelings
	Negative	Does not like computers

3 Discussion	CL	Their definition of computer literacy
	Anecdote	A story of their experience
	Adv	Advantages of computers
	Disadv	Disadvantages of computers
	Bestm	Best method of learning
	Age	Comments about age and computer use
	Wants	Anything they would like to do/learn
	Quals	Whether qualifications are important for computer literacy
	Misc	Miscellaneous

B7: Examples of analysis

Extract from matrix of interview data

Int.	Initials	Gender	Age	Group	1.1 Use	1.2 Changes	1.3 Skills	2.1 Early learning
18	DB	M	O	A	Data collection Access Spreadsheets	More complicated at times…easier in one respect It develops you…what you learn at work you can apply outside Pass on more information…have to be more detailed Helps you define what's acceptable and what isn't Might restrict communication	Good training Basic understanding of what you are doing	We did a one-day course I think I taught myself more than anything
22	GH	M	Y	A	For the database and to put checks…to get a picture of trends…so you can get these readouts so you can control	Helped a lot Better insight into what needs to be done to control the process Enables you to correct faults	Look at the odd program and the different databases	We got shown by whoever was in charge of this test

2.2 Learning now	2.3 Problems	2.4 Home use	2.5 Feelings	3 Computer literacy
I've spent a lot of hours just playing around with the computer Picking up tips	I'll probably ask…I think I'm competent at what I'm doing now	Just for work	It gets rid of the paperwork I suppose. I don't know whether it's substituting something else I quite enjoy putting the information in and I enjoy Excel I feel as though I get a lot of pressure in the job I'm doing	Someone who can do a database You could learn for the rest of your life about a computer
Somebody might see you putting figures in and say 'I know a better way…' I would have preferred to have had a training course	We've just got to get in touch with [IT manager]	For a majority of things Printing and stuff, certain files…some of the new jobs I've been learning Typing and saving Downloading music from the Internet	Yes…I think it's interesting and it's not until you get into it that you realise how good they actually are	Being taught what you need to know A good understanding of the computer system and knows all the basics I don't think you can class yourself as CL if you just know bits and pieces

Extract from question matrix

Int	Initials	Gender	Age	Group	1.1 Use
22	GH	M	Y	A	For the database and to put checks...to get a picture of trends...so you can get these readouts so you can control
23	KH	M	M	A	Enter data Operate the machines
27	CM	M	M	A	Input data E-mail Presentations
29	NT	M	M	A	To pass information Entering stuff

Extract from question file

Question 1 categories

Comms1

1:1

Well, I use it for quite a few things. I use it for communication via e-mail- we have a system called Lotus Notes that runs our e-mails and I receive and send e-mail messages, several, on average, per day and I may attach other files to those e-mails

2:1

Primarily now for communication. It's used internally in the corporation- a system called Lotus Notes is used for memos and written communication

3:1

Communication is the main thing...sending e-mails around the world everywhere, a lot better than memos, a lot faster.

4:1

I use it for sending e-mails, for sending faxes as well. The reception computer is the fax machine for things coming into the building so we have to get the faxes coming in, read them and redirect to whoever it is in the plant who the fax is for.